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JOURNAL
OF THE
ASIATIC SOCIETY
OF
✓
BENGAL.

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VOL. XI.

PART II. JULY TO DECEMBER, 1842.

NEW SERIES.

“ It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science, in different parts of *Asia* will commit their observations to writing, and send them to the Asiatic Society in Calcutta; it will languish, if such communications shall be long intermitted; and will die away, if they shall entirely cease.”—SIR WM. JONES.

CALCUTTA:
BISHOP'S COLLEGE PRESS.

1842.

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ASIATIC SOCIETY.

Contributions towards a History of the development of the Mineral Resources of India. By S. G. TOLLEMACHE HEATLY, Esq.

It is often imagined that whatever of scientific or commercial enterprise has been exhibited in India, bears a very modern date under the British rule; and that the fortunes once so rapidly accumulated here as to originate the mythus of the rupee tree, were simply the results of systematic trading in some, and of systematic speculation in others. Such an idea was easily suggested by the fact, that the already known produce of India, and the silk of Cathay, and the spice of Serendib commanded immediate sale, and enormous prices in the markets of the West; that the private trade of the factors bore a very respectable proportion to that of their Hon'ble Masters; that rajahs and dewans were thickly sprinkled over the land; and that nuzzeranas were legal and weighty in amount, and fine in carat. It was difficult therefore to conceive any inducement for men to engage in the arduous and difficult task of opening new paths to wealth, when the beaten tracks offered certain affluence to moderate exertions. Yet it will be found by the historical student of that period, that in spite of all these serious temptations to engage in active political intrigue, or to confine themselves to the less harassing duties of mercantile speculation, many a clear and powerful intellect employed its energies in the honourable, though wearing, task of developing the resources of the country: and that in many instances they effected, though unaided, almost as much

as has since been done with the help of refined legislation, improved science, public spirit, and the other peculiarities of the nineteenth century. The earlier adventurers to India under the Company's government (I refer to the period between 1750 and 1790) were, a large majority of them, far from being the coarse and vulgar beings it became the fashion subsequently to represent them. Often scions of ancient but decayed houses, men of liberal education, high principle, and intellectual activity, their correspondence exhibits views of commercial policy, national wealth, and the duties of the ruler which will be found far in advance of the age even in the mother country. Those who deviate into these records from the monotonous detail of bloodshed and perjury, cruelty in the strong, and treachery in the weak, which constitutes the staple of the written annals of this period, will find the perusal, what Coleridge called, "its own exceeding great reward." They will learn to estimate at its proper worth, the contemptible defence set up for some acts of Clive and Hastings, that they were suited to the time and the people among whom those statesmen moved. Pure and simple-hearted men will be seen desirous to repair their own fortunes; but anxious at the same time to be of benefit to the land which enriched them; working out their plans with patience and perseverance; oftentimes harassed by the injudicious interference of those in high places; successfully thwarted by the intrigues of others who considered their interests endangered by the out-turn of the new schemes: and not unfrequently stopped, at the very moment when their labours promised a result, by the imperative mandate of the home authorities. Sometimes retiring to repose on their well-earned affluence, they have been brought out again in advanced age, the mismanagement or dishonesty of others having ruined their fortunes; and they will be seen setting themselves cheerfully to rebuild the shattered edifice by some new expedient, the introduction of an exotic growth, a manufacture that might lessen importation from England, or one which might serve as a remittance thither.

Biographies, like these, are not interesting merely in an antiquarian light for the coming generation, but they have their utility for the present, shewing us what has been attempted afore of old time; the causes of failure, and the probability of success, if endeavours be now renewed in the same direction. The discovery and working of coal, iron, copper,

lead, silver and sulphur mines ; the boring of cannon ; the casting of shells and shot ; the glazing of earthen pottery ; the manufacture of porcelain ware ; of soda and potash ; of salt ; the introduction of mahogany and other plantations ; sugar ; cotton ; the establishment of fisheries at the mouth of the Hooghly ; the reclamation of waste lands in the Soonderbuns and in northern Bengal : each, and all, these belong to the last century—the days of Hastings, Clavering and Francis ; of McPherson and Cornwallis. With the last indeed came in a spirit of anti-colonization ; all encouragement to European enterprize and ability to work out the capabilities of the empire ceased. The subject being thus deprived of present interest, it is not singular that the memory of past occurrences should have fled by in a society constituted as is that of India. The retirement of some, the circulation of others into distant parts of the country, and the death of the rest, effaced at an early period the remembrance of what had been done : and the active duties imposed on all by the subsequently rapid extension of the British rule, left neither leisure nor inclination to the new comers to preserve the fading legends.

Having had my attention drawn some time ago to the history of mining in Bengal, and the liberality of Government in permitting access to their records having enabled me to extend my researches considerably, I propose to arrange their results in the course of two or three papers, in the hope of rescuing from “ dim forgetfulness,” the recollection of deeds and men already passing into the historical era. I could wish also to stimulate those who possess authentic information relative to the development of other branches of Indian industry to do so likewise, while it is in their power. Not a few of the documents registered in government offices, which would have thrown much light upon my task, no longer exist. A few short years, and what is now difficult, will become impossible.

Memoir on the Discovery and Working of Coal.

The earliest documents which I have been able to trace containing notices of the existence of coal in Bengal, bear date 1774, and they concur in assigning the priority of discovery and working

of coal mines in the districts of Bheerbhoom and Pachete to Mr. Suetonius Grant Heatly. On the 11th August 1774, the Council of Revenue received the following application and proposals:—

TO THE HON'BLE WARREN HASTINGS, Esq. *President, &c.*

HON'BLE SIR AND SIRS,—I have the honour to present to you, in the name of Mr. Suetonius Grant Heatly and myself, “Proposals for working coal mines and selling coal in Bengal,” in consequence of our having discovered certain coal mines in Pachete and Bheerbhoom, and I assure you, Gentlemen, that in case you will be pleased to grant us the indulgences we request, that we will endeavour to prevent all disputes with the country people, and in general to render the execution of what we undertake, subservient to every good purpose the nature of the work will admit. I am, &c.

CALCUTTA,
August 11, 1774.

JOHN SUMNER,
For Sumner and Heatly.

Proposals for Working Coal Mines and selling Coal in Bengal.

That an exclusive right be granted to us for eighteen years of working coal mines and selling coal in Bengal and its dependencies, so long as we can engage to furnish as much pit-coal as ever the Government may bespeak of us for their consumption at the market price of the time, when wanted.

That in case we discover any copper, lead, or any other mineral or metal, except iron, in digging the six mines we have discovered, that is to say, within the space included by the river Adji to the north, the border of Burdwan to the east, the river Dummooda to the south, and a circular line to the west, described from the town of Aytura in Pachete, at the distance of ten miles from Aytura, between the one river and the other, we may have the property of the same, and we agree to pay a fifth part of their produce to the Honorable Company. In case of our discovering iron ore, we will report it to the Board, and wait their pleasure on the subject.

That we will furnish the Honorable Company with ten thousand maunds of pit-coal every year, for five years to come, (if we dig so

much,) at the price of two Arcot rupees, and three quarters per maund, (of 80 Sicca weight to the seer,) and after the expiration of five years; and we will annually, at the market price of the time of sale, furnish the like quantity, and we desire liberty to sell in Bengal, or export whatever quantity the Honorable Company may not bespeak of us.

That some uncultivated lands contiguous to the mines we work may be granted us, both because coal mines are known to vary and spread different ways, when the vein is sometimes lost and found again at a distance; and because we may be able to entice the labourers in future to settle on the spot, and if to this indulgence be added some contiguous cultivated lands, to the amount of about six thousand rupees rent, to be let out to us from the catcherry of the Burdwan division, we hope it will prevent our workmen from committing trespasses or any encroachments under any pretence on other revenue lands, as they may, within our own circuit, be then furnished with provisions and necessaries by having a market to go to.

That the Government will be pleased to allow us to employ Europeans in the work we are about to undertake, on our engaging to be security for their good behaviour up the country.

That if the above six mines fail, or do not turn out of a quality for the Company's works, we may be allowed on the above terms to dig any other mines that we may discover on our pointing them out to the Government. But we do not desire to have a property in any metals or minerals we may discover, except in such parts of Pachete and Bheerbhoom, as are within the limits of the Adji and Dummooda, &c. as above described.

JOHN SUMNER,

For Sumner and Heatly.

CALCUTTA,
11th August, 1774.

On the perusal of these it was resolved,

That the Board approve of the proposals, excepting the latter part of the 4th article, respecting the farm of cultivated lands in the neighbourhood of the mines, which they are of opinion may be allowed as a present indulgence to the proposers; but to be resumed whenever

their possession of them shall become liable to objections, and excepting the 6th article which is premature, notwithstanding the encouragement which they think a discovery of this kind merits from Government; yet as a precipitate acquiescence to them may be attended with ill consequences to the collections,

Resolved,—That we decline coming to a resolution until the sentiments of the Provincial Council of Burdwan have been received upon them, and that this proposal be referred to them for that purpose.

The following letter was accordingly written :—

To GEORGE VANSITTART, Esq. *Chief, &c.*

Provincial Council of Revenue at Burdwan.

GENTLEMEN,—Accompanying we transmit you copy of some proposals, which have been presented to us by Messrs. John Sumner and Heatly, together with an extract of our proceedings on the subject. We desire you will agreeably thereto, forward to us your sentiments on them. We are, &c.

WARREN HASTINGS,
WM. ALDERSEY,
P. M. DACRES,
JAMES LAWRELL,
JOHN GRAHAM,
NICHOLAS GRUEBER.

FORT WILLIAM,
The 11th August, 1774.

On the 23d August, the answer was submitted to the Board.

To THE HON'BLE WARREN HASTINGS, Esq. *President, &c. &c.*

HONOURABLE SIR AND SIRS,—We have been honoured with the receipt of your letter of the 11th instant. If the revenue of the cultivated lands, which Messrs. Sumner and Heatly request to be allowed, be equitably adjusted with the present farmers; if effectual care be taken, that they do not force people to work for them, nor erect Gunges in such a situation as to ruin any that are already established, and further, if the Europeans they may employ be removable without absolute and formal proof of their misbehaviour, and no protection be given by them to Ryots, who may desert from their farmers, with balances due from them on account of their rents; with these precautions,

it does not occur to us that the scheme can be attended with any ill consequences to the collection. We are informed that iron is already manufactured within the limits they describe. We are, &c.

GEORGE VANSITTART,
JOHN BATHOE,
ALEXANDER HIGGINSON,
CHARLES FLEETWOOD.

BURDWAN,
The 15th August, 1774.

The following Resolution was passed on the Burdwan Report:—

Resolved,—That in consequence of the opinion given by the Chief and Provincial Council of Burdwan, a lease be granted to Messrs. Sumner and Heatly, upon the terms of which we have already approved, and with the following Resolutions.

First.—That they shall not compel people to work for them.

Second.—That they do not erect gunges or golahs of any kind, but be allowed only to establish bazars for the use of the people whom they may employ, and those subject to such regulations or occasional orders as the Chief and Provincial Council of Burdwan may think proper to issue.

Third.—That the Europeans or any other persons employed by Messrs. Sumner and Heatly, shall be liable to be recalled by the Chief and Provincial Council of Burdwan, without a reason assigned.

Fourth.—That they shall not receive or grant protection to any ryots who may desert from the farmers or officers of Government, with balances due on account of the rents, on penalty of forfeiting in every such instance treble the amount of the balances which shall be claimed as due from the said ryots by the Chief and Council of Burdwan.

Fifth.—That they shall at all times submit to and agree to abide by the judgment of the Board or of the Provincial Council of Burdwan, in cases referred to the said Council, without any other appeal.

Sixth.—That they shall not transfer the grant to any other persons, unless by express permission of the Board; but in the event of their abandoning the undertaking, surrender it again to the President and Council of Fort William.

Ordered,—That the Secretary do transmit a copy of these Resolutions, together with our former Resolutions of the 11th instant to

Messrs. Sumner and Heatly, and that he do inform them of our acquiescence to their proposals on the terms mentioned in our Resolutions.

On the 4th October, the matter came again before the Board.

To MR. RICHARD SUMNER,

Secretary to the Revenue Department, Fort William.

SIR,—We have been honoured by the Board's answer, transmitted by you on the 24th August in respect to our proposals offered the 11th August, and we have now to request such orders as may be judged proper to the Council of Burdwan, and to have a grant (for working the coal, &c.) to the names of Sumner, Heatly, and Redfearne, as we all three are proprietors, and this is our firm. Moreover, we hope that as the time for the despatch of the ships is at hand, the Board will be so favourable to us as to represent our discovery to the Honorable Court of Directors, as their sanction will be a great encouragement to us in the work we undertake. We are, &c.

CALCUTTA,
30th September, 1774.

J. SUMNER,
S. G. HEATLY.

Order.

Agreed,—That they be admitted joint proprietors, and that the following letter be in consequence written to Burdwan :—

To GEORGE VANSITTART, Esq. *Chief, &c. &c.*

GENTLEMEN,—Having thought proper to grant to Messrs. Sumner, Heatly and Redfearne, a Grant for working the coal we before corresponded with you about in the districts under your division, we, enclosed, transmit you a copy of the engagements they have entered into. We are, &c.

WARREN HASTINGS.
W. ALDERSEY.
P. M. DACRES.
JAMES LAWRELL.
NICHOLAS GRUEBER.

FORT WILLIAM,
The 4th October, 1774.

Ordered,—That the Secretary do transmit the necessary materials to the Company's Lawyer, directing him to prepare a Grant accordingly.

At this period the partners were employed on active service by Government; Mr. Sumner at the head of a commission, and Mr. Heatly to quell some serious disturbances at Mirzanagore in Jessore. Redfearne never took any part apparently in the coal work, and was stationed at Nuddeah. At length in September 1775, the following letter was received by the Board:—

TO THE HON'BLE WARREN HASTINGS, Esq.

Governor General, &c. and Council.

GENTLEMEN,—We have the honour to acquaint you with our having imported from Pachete about two thousand and five hundred maunds of coal, in part of the quantity which we offered to furnish the Honorable Company with, at 2/12, (two Arcot rupees and twelve annas) per maund, and it is now ready to be delivered to your order. We are, &c.

CALCUTTA,

JOHN SUMNER,

15th September, 1775.

For Sumner, Heatly and Redfearne.

Ordered,—That the coal be delivered to the Military Store keeper, and that he do report the quality of it to the Board.

The Store-keeper did not, however, furnish any report. Mr. Sumner was deputed with Messrs. Pye and Adair to examine the Hidgellee salt accounts, which very fully occupied his time. And Mr. Heatly was Collector of the united districts of Ramgur, Palamow, Chota Nagpore, and Gautkondory, where he had small leisure for speculations. In November 1777, both having returned to the Presidency, they renewed their endeavours to carry out the work.

TO THE HON'BLE WARREN HASTINGS, Esq. &c. &c.

GENTLEMEN,—I request the favour of you to order two thousand maunds of pit-coal to be received into the Honorable Company's stores. This quantity is a part of what has been dug out of mines at Pachete by the discoverers, and it has been sometime laying in Calcutta. I am, &c.

CALCUTTA,

JOHN SUMNER,

15th November, 1777.

For Sumner, Heatly and Redfearne.

Ordered,—That the two thousand maunds of pit-coal be delivered to the Military Store-keeper, and that he be directed to receive charge of it.

Ordered,—That Messrs. J. Sumner, &c. be advised accordingly.

TO MAJOR JOHN GREEN, *Commissary of Stores.*

SIR,—Agreeable to the directions of the Honorable the Governor General and Council, I request you will please to receive into the store two thousand maunds of pit-coal, which has been sometime since imported into Calcutta by Messrs. Sumner, Heatly and Redfearne. When you have received the same, you will please to inform me of it. I am, &c.

FORT WILLIAM,
19th December, 1777.

GEORGE LIVIUS,
Military Store-keeper.

Major Green on the receipt of this letter, addressed Mr. Hastings on the quality of the coal not being fit for the purposes for which it was required by Government, and on the 24th December, Mr. Hastings brought the matter before the Council.

The Governor General lays before the Board, the following letter delivered to him by the Commissary of Stores, addressed to him by the Military Store-keeper, and submits to the Board the propriety of ordering, that the coals in question may be first examined and reported fit for use by the Commissary of Stores before they be received, in consequence of the resolution passed on the 18th August 1774, and that if they should not appear to be fit for use, that the Military Store-keeper be directed to return them to the proprietors.

The letter referred to is Livius's. The Board agreed to Mr. Hastings's proposal, and it was "*Ordered*,—That the Commissary of Stores be directed to examine the coals, agreeably to the Governor General's proposition." The report was soon sent in.

TO THE HON'BLE WARREN HASTINGS, Esq. &c. &c.

HONORABLE SIR AND SIRS,—According to your order of the 24th December 1777, transmitted to me by your Secretary, I now enclose

a report of the coal furnished by Messrs. Sumner, Heatly and Redfearne, compared with sea-coal sent from Europe. I have, &c.

FORT WILLIAM,
20th January, 1778.

JOHN GREEN,
Commissary of Stores.

A report of the trial made between the British sea-coal and the country coal furnished by Messrs. Sumner, Heatly, and Redfearne, Fort William, the 13th January, 1778.

Country Coal, one maund.

Two welding heats were given to fifteen seers of iron, one foot long, two and half inches broad, one and half inch thick. The first heat required thirty-seven minutes, the second with the same fire and the remainder of the coals was sixteen minutes.

N.B.—It burns away very quick, the refuse is nothing but clinker slate and dirt, without the least remains of cinders or clean ashes, and it wastes the iron very much. Yet these coals are far preferable to those sent for a former trial.

British Sea Coal, one maund.

Two welding heats were given to fifteen seers of iron of the above dimensions. The first heat required thirty minutes, the second heat five minutes, with a quantity of coals remaining sufficient to have given two more heats.

N.B.—It is plain from this trial between the two sorts of coals, that with one maund of the British, the same work may be performed that can be done with two maunds of the country, in much less time, and with not near so great a waste of iron.

JOHN GREEN,
Commissary of Stores.

The Government resolution in consequence of the report, closes the official correspondence of this period.

Ordered,—That the Military Store-keeper be directed to return the coal to the proprietors; but that they be informed, the Board will give them all reasonable encouragement in the prosecution of their

undertaking, and that they have no doubt from this trial of their meeting with good coal, if they will be at the trouble of searching deeper for it, as this appears to have been gathered only from the surface of the mines.

Mr. Sumner retired at this period to England. Mr. Heatly alone remained in the neighbourhood. Tradition current in our family relates, that he brought out regularly-bred miners from Europe, and local tradition, according to Mr. Jones, confirmed the fact of Europeans having been engaged in the work, but carried off by a destructive fever. The certainty of a market was however gone, and the exertions of the proprietor became consequently less energetic. It happened singularly enough, that at the very time Government declined taking coals of the quality sent, new purchasers suddenly appeared on the very spot. In December 1777, Messrs. Farquhar and Motte addressed Government to be permitted to bore cannon for them, and to cast shot and shells, in a memorial which I shall have occasion to notice in a future paper. It has the following passages:—

“ After having obtained the best information in our power, we are of opinion, that the pergunna called Jerriah, lying between the rivers Dummooda and Burraker in the province of Pachete, is the fittest situation for the iron works. The river Dummooda is navigable as high as that place. It abounds with iron ores, and has the singular advantage of being contiguous to the coal mines of which Messrs. Sumner and Heatly have a grant.” Another passage runs thus: “ By this article, however, we have no idea of prejudicing the rights of Messrs. Sumner and Heatly, who you know, Gentlemen, have the exclusive privilege of working the mines of coal or of any mineral or metal, iron excepted, within certain districts of Beerbhoom and Pachete.”

It is not probable, however, that Mr. Farquhar (known subsequently as the purchaser of Fonthill Abbey from Beckford,) proved any very profitable customer to the mines. Disease and death thinned the number of Europeans employed on them. Government began to see the impropriety of permitting their revenue and judicial officers to engage in farming speculations, and the orders of July 1781, prohibiting

the lending of money on such accounts, was intended as an intimation of their opinion to the service. Mr. Heatly was now appointed to the chiefship of Tirhoot and Purnea, which precluded all personal superintendence on his part. I can trace nothing more at present of his subsequent connexion with the mines. As the iron mines continued to be worked long after, he may have let the coal mines to Mr. Farquhar. If not, the well known economical disposition of the latter makes it exceedingly probable, that he availed himself of the "singular advantage of contiguity" to carry them on for his own benefit, without hindrance on the part of the proprietor.

Independent of the want of a regular market, another powerful cause came into operation a little after, to repress the energies of private speculators.

I have said that Lord Cornwallis brought out a disposition systematically opposed to anything like colonial independence. Smarting under the humiliation inflicted on him by the Americans, he undeviatingly discouraged colonization. No plan which tended to make India a self-dependent state met his approbation, and at no period of the empire here do the records exhibit such a bareness of projects for developing the resources of the country. Under such auspices, it was not to be hoped that either the original proprietor or other individuals would attempt the resuscitation of the mining project, and accordingly in a short time the "young forgot it, and the old had died." Round its history grew

A daily darkening pall : it sank subdued,
In cold and unrepining quietude.

A brilliant career was opened to Mr. Heatly whose social qualities, and American-royalist connexions, had made him a personal favorite with Cornwallis, and his time was fully engrossed by it.

It has been said before, that Mr. Heatly was appointed Collector of Ramgur and Palamow in 1775, a situation he held till December 1776. During this period, he was employed in examining the resources of the country with a view to its settlement. Warm with the affairs of his Bheerbhoom coal mines at the very time, I think it is hardly possible that he could have overlooked the mines of coal in Ramgur and Palamow, although the troubles which demanded his vigorous efforts for their settlement may have prevented him from devoting much atten-

tion to them. He applied for a surveyor to complete a map of the several districts under his charge. Lieut. Ranken was, at his request, appointed and prepared a map, which yet exists at the Surveyor General's Office. It does not mention a word about the existence of coal, and I am therefore inclined to attribute the notification of a coal mine situated on the river Coyle, a little below Palamow, to Mr. Heatly, who was on intimate terms with Rennell, then Surveyor-general. Rennell's map of Behar, dated 1779, announces the fact, and Arrowsmith has only copied it into his Atlas from Rennell's.

From this period there is a wide gap. In Williamson's "Wild Sports in the East," (an admirably characteristic work, published in England in 1808, and pretty nearly as unknown now as the times he delights to paint were in his,) there is an incidental allusion to coal. It occurs in pages 7 and 8, Vol I.

"Cooking is carried on in the open air by means of embers; coals "being unknown in India, except in the Ramgur country, where the "Soobanreeka river runs for some miles through a mine of excellent "quality. The country being extremely mountainous, and no navigable "river within at least a hundred miles, though small streams abound, "added to the vast abundance of fuel, occasions that valuable commo- "dity to be neglected. The India Company indeed find it easier to "send coal from England, as ballast, to their arsenals abroad, where "quantities are occasionally used in fusing metals for casting ordnance."

It was singular enough, that at this very period the India Company *did not* indeed find it easy to send coal from England. In a general letter, dated 8th April, 1808, paragraph 24, they point out to the local Government the enormous expense to which they were subjected by the exportation of coal to India; wishing to know the purposes for which it was wanted; whether charcoal will not be equally servicable, and stating if no remedy can be devised, that they must transfer their ordnance works home. The Earl of Minto was then Governor General, and drew the attention of the Military Board to the complaints of the Court of Directors.

TO CAPT. A. GREENE, *Secretary to the Military Board.*

SIR,—I am directed by the Right Honorable the Governor General in Council to transmit to you the enclosed copies of the 23d, 24th, 27th,

and 28th paragraphs of a General Letter from the Honorable the Court of Directors, dated the 8th April last, for the information and guidance of the Military Board. I am also directed by his Lordship in Council, to call for the sentiments of the Military Board, with regard to the practicability of substituting Bheerbhoom coal for sea-coal for purposes to which the latter is applied. I am, &c.

COUNCIL CHAMBER,

T. THORNHILL.

5th Sept. 1808.

I need not quote the whole of the Board's answer. It states, that an ample supply of sea-coal is actually a saving of expense, as charcoal is inadequate to the same work ; and " that the Honorable Court in their General Letter of the 12th July 1805, particularly require that this article shall be regularly indented for." This last hint seems to favour a surmise of Messrs. Sumner, &c. that they were unfairly dealt with, owing to the strong interest made by the coal contractors at home. The Board go on in their third paragraph :—

" As the Military Board have never had an opportunity of seeing
" or knowing the quality of Bheerbhoom coal, they request to be
" favored with a communication of any information that the records
" of Government may contain on the subject of it, and in what manner
" some of it may be obtained for the purpose of trial at the Agency
" Yard."

It was, however, not thought worth while consulting the records of Government, and his Lordship in Council directed the Collector of Bheerbhoom to procure and forward to the Commissary of Stores, a quantity of from fifty to one hundred maunds of the coal to be found in that district, reporting at the same time for the information of the authority, any particulars connected with the object of the proposed experiment which he may be enabled to collect from local enquiry respecting the quality of the coal, and the state and situation of the mines from which it is procured. His Lordship stated as his reason for this inquiry, the desirableness of ascertaining " by experiment whether the coal of which there are reported to be extensive mines in the districts of Bheerbhoom, can be advantageously used or not, as a substitute for

the sea-coal annually required from England."—*Letter from Military Department to Military Board, dated 19th September, 1808.*

On the 17th February 1809, a specimen of Pachete coal, obtained from a mine discovered near the village of Cheenacoory, close to the Damooda river, and which is stated to be very abundant, was forwarded for the above object to the Military Board.

On the 12th May following, a further communication was made to the same end, with another sample of coal, on whose qualities a particular report was demanded by Government. Certain correspondence, in connection with this sample, was also handed to the Military Board, which turned out to be of exceeding interest in regard to the former labours of Mr. Heatly. The letter from the Collector of Burdwan is the first.

To B. CRISP, Esq. *President, and the Members of the Board of Revenue.*

GENTLEMEN,—Agreeably to the instructions contained in your Secretary's letter of the 7th ultimo, and its enclosures, directing me to ascertain whether coals are to be procured in this district, I applied to Mr. Thomas Marriott, a gentleman whose long residence in this district and local knowledge, qualified him to give the best possible information on the subject. I feel myself much indebted to Mr. Marriott for the trouble he has taken, and should Government propose taking any further measures in the business, I beg leave to recommend him as a very fit person to be employed. I have this day despatched by the Dawk Bangee, addressed to your Secretary, a muster of the coals I have received from Mr. Marriott. I have, &c.

BURDWAN, COLLECTOR'S OFFICE,

C. TROWER, *Collector.*

8th April, 1809.

I give Mr. Marriott's enclosures in full. This gentleman, I presume, was a son of Mr. W. Marriott, who had been a Member of the Provincial Council of Burdwan in Mr. Heatly's time, and to whom therefore the circumstances of this discovery was familiar.

“My enquiries regarding the coals have been attended with so much success, that I cannot avoid the pleasure I feel in communicating them to you. I returned from Jewsuttee the day before yesterday, and brought with me two seers of coal, which I picked up near that place out of the water, and this morning made a trial of it by burning, and find that it burns excellently, having been lighted early in the morning, and still continues. On my arrival at Jewsuttee, I accidentally met with a man who is a resident of that part of the country where the heap of coal, to which I alluded in my former letter, is lying. Upon enquiry, I found that he was well acquainted with all the circumstances of Mr. Heatly having dug the coal, and of the heap being still in existence; and as a most corroborative proof that he did, he told me that the potters at that place used it for burning their pans, &c. Pleased at having thus obtained so much information, I immediately sent off a peon with a bullock, and ordered every enquiry to be made as to the spot from whence the coal was taken. The coal which I took up from the river is doubtless a part of the heap at Mudjea. But this could not have been the case with the coal taken up by Lieutenant Delamain at the Goomea Ghaut, which is many coss above Mudjea. I have not the least hesitation in giving my opinion, that I shall be able to ascertain the exact spot of the mine, should the Government deem it worth their while to make further enquiries on the subject. I have enclosed a sample of the coal, and I shall forward the bullock the moment it arrives.”

T. MARRIOTT.

29th March, 1809.

“In reply to your favor accompanying the public enclosures, requiring any information I might possess regarding a stratum of coal said to exist in the vicinity of this district, I have the pleasure to state, that my enquiries on this subject have been attended with much success, to which I was fortunately guided by having previously travelled in that part of the country many years ago, in which the stratum is situated. As I presume that it is unnecessary to trouble you with a repetition of what I have already mentioned in my former letters, regarding my

having seen the heaps of coal lying at Mudjea, in Pachete, on my way to Jellida in 1782, I shall only further observe, that it was entirely owing to that circumstance that I was led, upon receiving your letter, to send people to the spot, to ascertain whether the heap of coal still existed; and also to make enquiry from the inhabitants as to the positive place from whence the coal was originally brought, and by whom.

“My people returned only a few days ago, and informed me, that owing to the floods, the bank at the village of Mudjea had been cut away, and that the coal in consequence had fallen into the river, and spread in different directions to a very considerable distance; that the inhabitants, in the prosecution of their enquiries, from fear or other causes, shewed great reluctance at answering any questions. But they at last met with an aged Bramin, who informed them, that the coal had been brought by Mr. Heatly, from a place named Chenacoory, and also from a spot situated in the Jungle of Damaully. The places are represented as being within nine coss of Mudjea, on the same side of the river, to the westward. It appears to me possible, that Kissencooney, marked in Rennell’s map No. 7, is the same village specified by the Bramin; because the distance of that village from Mudjea agrees nearly with the Bramin’s name of Cheenacoorey, and this is more likely, as the names of villages throughout Rennell’s maps are frequently strangely disfigured by the mode of spelling.

“The stratum of coal is stated to be in the bed of the river, on the verge of the river, lying in flakes, and to be very abundant. The sample of coal which I have sent accompanying is brought from below the village of Mudjea, and taken up from the bed of the river, and is doubtless part of the heap originally collected at that place. Upon inspection, it will appear evident, that it must have laid in the water for a very considerable period, as the angles are in some pieces much fretted and worn off, and in others totally destroyed. I am much vexed that my people did not proceed to Cheenacoory, as they ought to have done. I have sent them back to ascertain the veracity of the Bramin’s assertion, and expect that they will return in a few days.

“I shall not presume to offer any scientific opinion as to the quality of the coal, but merely state, that on a trial, I found that it burnt extremely well, afforded a very strong heat, and leaves a residum that is very considerable, compared with the original bulk.

“Regarding the stratum of coal of which Government have received some information through the communications of Lieut. Delamain and others, I have not been able to make any discovery worthy of notice. In my way down from Shahabad in 1797 to Burdwan, I crossed the Dummooda river at the same ferry that Lieut. Delamain did, which is called the Rajeghaut, and also the Goomeahghaut, (vide Rennell’s map, No. 8, Gopur). To the north of the ferry, at the distance of three or four coss, there is a brook or rivulet, by the side of which I recollect seeing a hot spring, that in some places burst with a flame and caused a strong sulphureous smell. In the vicinity of this spring a stratum of coal may exist, some fragments of which Lieut. Delamain may have picked up from the bed of the Dummooda river that runs so near to the source of the spring, distant only four coss from the ferry, and into which the rivulet discharges itself. However this may be, it is highly improbable that the coal which I have collected and delivered as a sample, can be from any stratum alluded to by that gentleman, as the ford at which he passed is above forty coss beyond the spot that I have specified.

“As incurring the expense of travelling for local investigation without any immediate prospect would not suit my present circumstances, I must confess, however my inclination leads me, I have not been induced to undertake the journey. But if the Government should deem it worth while to ascertain any further points on this subject, and employ me for that purpose, I am willing to do the utmost in my power, and trust that no objections may be made to defray my travelling charges, which I presume would hardly exceed three hundred rupees. In making this tender of my services, I cannot avoid remarking, that my knowledge as a mineralogist is very confined, and that it appears a business requiring a person well versed in the nature of coal, of which it would be uncandid not to declare my ignorance.

“I beg leave further to state, that during my enquiries regarding the stratum of coal in Pachete, I have been informed by a man belonging to Tellotoo in Shahabad, that the coal is an article well known in that part of the country by the name of *Khaurdhur*, and used there on some occasions medicinally. It is to be found at a place named Thoorah, on the southern side of the Soane river, three coss above the Coyle river. Here are also quantities of coal to be found in the bed

of the Buccooah nulla, that is only half a coss from Kussyau, a place well known, which evidently discovers that there must be a stratum. It was near to this village that Mr. Prinsep many years ago found copper, and commenced an extensive manufacture of vitriolic acid."

BURDWAN, April 6.

T. MARRIOTT.

It appears from this letter of Mr. Marriott's, that the sample of coal sent down by him for Government, and by Government to the Board for a particular report, was part of a heap lying at Mudjea, but dug at Cheenacoorey and Damully by Mr. Heatly. Upon this sample we have the subjoined

Minute by Lieut. Col. HARDWICKE.

In compliance with the desire of the Military Board, I have the honour of making a communication on the Pachete coal, submitted to me for experiment and report thereon. In the first place I shall notice some particulars and peculiarities descriptive of the substance in question, and then give the result of the few experiments made upon it. In its appearance and some of its properties, it approaches nearer to the "bituminous oxide of carbon," known in England under the denomination of Bovey coal, than any other substance I can compare it with. In texture it is lamellar, the laminæ subject to two very dissimilar appearances, the one evidently marked with the woody fibre, and resembling pure carbon or charcoal; the other of a full shining black, opaque, very brittle, and breaking with a rhomboidal fracture, both irregular and mixing one into the other. The first rubs easily into powder, and sticks to the fingers on handling; the other does not soil the fingers when rubbed. Its specific gravity is greater than the coal here used, called sea-coal, being to that as 145.75 is to 135, taking water at 100 as the standard of comparison for both. It burns with a clear whitish flame without sparks or crackling, as coal and charcoal commonly do; emits little or no smoke, and without odour, burns for a considerable time without producing ashes, and with little change to either its form, bulk, or weight. The degree of inspissation in this bituminous substance must be very great, and the carbonic principle so prevalent, that it can scarcely be termed bituminous. In combustion, it discovers none of those appearances common to good coal; it

neither runs into mass, nor forms the least adhesion one piece with another; the laminæ shew a partial separation from each other, and sometimes curl up. Its appearance after considerable exposure to heat is slaty, and the few ashes formed, and adhering to the surface, of a ferruginous brown.

Experiment 1st.

Two lbs. weight of this coal was exposed to the strong heat of a blast furnace in an open crucible for one hour and forty-five minutes, and lost only eleven ounces of its original weight. The last ten minutes of this experiment it gave no flame. The appearance when cold, was as stated above, with this addition, that many of the black shining parts remain unchanged, shining with a vitreous texture, and more brittle than before.

Experiment 2d.

In the smith's forge, I found it inferior to common charcoal for producing the desired heat for working iron: and the same bar of iron which in about eight minutes under the heat of a common charcoal fire threw off scintillating sparks from its surface when taken from the forge, gave a very different appearance after being twelve minutes in the forge heated with the Pachete coal. The bar came forth with a rather dull heat, threw off no sparks, and the iron instead of yielding freely to the stroke of the hammer, flew off in large scales from its surface; and the workmen unanimously pronounced this fuel unfit for their use.

Experiment 3d.

I tried it also in combination with the English coal, the result was an inferior heat to that produced from Europe coal and charcoal.

Under such demonstrative proof, I do not hesitate to express my opinion, that the discovery of this coal promises no advantage for the uses of our Blacksmiths in iron work: but for household or culinary purposes, I think it may be found very desirable. For a house in particular to burn in grates or stoves, I think it desirable. It gives heat enough for our houses in India; is free from sulphureous smoke or the suffocating effect of charcoal, and makes little or no dirt. In

kitchens it will be found a desirable substitute for charcoal, if the expense of obtaining it should be less, and which must most likely be the case where the facility of water conveyance is at hand.

May 19, 1809.

T. HARDWICKE.

Under such demonstrative proof, with the circumstances known to all parties under which the sample was picked up, the Pachete coal was once more doomed to be shelved.

Simultaneously with the letter dispatched to the Burdwan Collector, similar instructions had been sent to the Collector of Bheerbhoom. His answer stated, that coal had been discovered in the Zemindaree of Jerrea; that the beds were superficial, and *have never been worked, the natives being entirely unacquainted with the nature and qualities of the substance!* He further stated, that the coal was slaty and burned to white ashes without leaving any cinders: that it might be transported to Calcutta by the new road, at an expense of eighty-five Rs. per 100 maunds, but by boat during the rains, the cost would be twelve Rs. per 100 maunds.—*Letter from Mr. Suttie to the Board of Revenue, 2d June, 1809.*

The Governor General in Council, for the present suspends passing any final orders on the subject of Lieut. Col. Hardwicke's report, respecting the specimens exhibited of Pachete coal: it being the intention of Government, at a convenient opportunity, to depute a professional person into that district, for the purpose of making further enquiries into the nature and situation of the coal in question.—*6th June, 1809.*

It is necessary to say a word here of Lieut. Delamain's discovery, not only because it is mentioned by Mr. Marriott in his letter, but because the Coal Committee have assigned to it the palm of priority in the district. On receiving the letter from Government, dated 19th September, stating the orders to the Collector of Bheerbhoom, the Military Board returned a reply on the 27th, saying, that *they* had

been recently informed of there being a considerable stratum of coal in the bed of the Dummooda river, very near to the place where troops coming down the country are accustomed to cross that river in the Burdwan district. On the 3d January, 1809, the Board wrote again, mentioning Lieut. Delamain as the discoverer, and that he had been written to for particulars. Col. Hardwicke, who was the informant of the Military Board, had "no better evidence of the fact than is obtainable from the enclosed note from Mr. Moreton." The enclosed note ran thus:—

"I remember to have seen some pieces of very fine coal in the possession of Lieutenant James Delamain, who had taken them from the bed of the Dummooda, at or near that part of it crossed by the 7th Regt. of Native Infantry on its march from the Upper Provinces to Barrackpore, some four or five years ago. I am likewise informed by a gentleman, who has resided in the district of Burdwan, that he has frequently taken up pieces from the bed of the river at a place about five or six coss above the Civil Station, and if I am not mistaken, you will find some particulars on this subject in a work lately published, and denominated "Wild Sports of the East."

W. MORETON.

On the 24th January, 1809, Lieut. Delamain sent in his explanation.

TO LIEUT. T. MADDOCK, *Assistant Secretary to the Military Board.*

SIR,—In reply to your letter, dated the 3d instant, I request you will state to the Military Board my regret, that the specimens of coal which I had by me, have in the course of moving, been all lost.

It may afford, however, some slight guidance to mention, that I took the pieces of coal out of the Dummooda river, when the 7th Regiment marched down in December 1802, at the first ford between the village of Gomea and Angbella, (for we crossed it twice). The fragments though numerous, were all small, and strewed about immediately at the ford. As I did not burn any of it, I could not ascertain whether it were of a good or spurious species. It seemed however of a slaty structure, harder than the common coal, soiling the fingers but little when rubbed, and the colour approaching to grey. I am sorry that

no opportunity has offered to enable me to give the Military Board the slightest information relative to the stratum of coal in Burdwan.

I am, Sir, &c.

KISSENGUNGE,
16th January, 1809.

J. DELAMAIN,
Lieut. 7th Regiment.

Lieut. Delamain's discovery therefore was confined to picking up some pieces of coal from the bed of the Dummooda in 1802, twenty-eight years after Messrs. Heatly and Sumner had imported four thousand maunds into Calcutta from the district, and while large heaps from their mines were lying about the country, their origin being familiarly known to the inhabitants. It is however interesting to see, that this discovery of Lieut. Delamain anticipates that of Col. Shelton years after, as the locality is precisely the same—the ford of Angbella, on the Benares road.

In 1814, under the spirited administration of the Marquis of Hastings, the slumbers of the Military Board were once more disturbed. Referring to the suspension of final orders on the 6th June, his Lordship stated his anxiety to ascertain beyond a doubt, whether the coal of India was of a quality calculated for the purposes of the forge. So far from being discouraged by the results of previous experiments, he considered them to afford a strong presumptive proof, that there is coal here well calculated for military purposes; that surface coal may be expected to fail here as in England, where some of the excavations reach the depth of 205 yards before proper coal is met with; that a qualified person will be despatched with the requisite apparatus, as soon as possible, to any spot the Military Board think the best, suggesting Cheenacoory to their consideration.

The Board replied, that their information was too limited to permit them to hazard an opinion; suggested the Collectors of Pachete and Burdwan as the best authorities, and recommended that the person to be deputed should examine the district before commencing his boring, and submit his plan of arrangements and details to Government for their consideration.

It was well known at this time, that Mr. Matthew Smith, an eminent shipwright in Calcutta, used the Pachete coal to a large extent in his

forges. To him therefore Government applied directly for information. His answer is dated 14th March 1814. He states, that he has never been to the spot, but is told that it is Jarrea Cottra, about thirty coss from Bancoora; that the coal is from the surface, therefore too slaty and bituminous to answer every purpose of the forge; that even now he met occasionally with very good coal, and was sure that if they dug deeper, much better could be obtained. That he procured it for little more than the cooly hire, or eleven annas the cist, and had imported several thousand maunds, which he used in combination with charcoal. Mr. Smith also stated, that he obtained nails from the same place, manufactured from the iron ores of the neighbourhood with the aid of the coals; concluding with recommending Mr. W. Jones to the notice of Government as a person conversant with mines and collieries, and one "who from his great knowledge of mechanics, could soon ascertain if better coal could be found lower in the earth."

Mr. Jones, who had never been in the district before, was accordingly deputed by Government to examine it on an allowance of 600 Rs. a month. Meeting my father occasionally in town, he soon learnt all Mr. Suetonius Heatly's exertions in the working of coal, and was directed to the various sources of information. On his return, he mentioned that the remains of Mr. Heatly's works were distinctly visible, that the natives knew their origin, and stated them to have been conducted by Europeans, who fell a sacrifice to a pestilential fever. It is not therefore very creditable to Mr. Jones, that both in his papers in the Transactions of the Asiatic Society, as well as in the official correspondence which he held with various Government officers, not a single word alluding to any labours prior to his own is to be found.

From the time of Mr. Jones, the question of the value of Bheerbhoom coal has been settled, thanks to the energy of the distinguished nobleman, who then directed the councils of India. The labours of later discoverers will be found in the reports of the Coal Committee in sufficient detail. I have already sufficiently trespassed in length, having been, to speak in the quaint language of Williams' Natural History of the Mineral Kingdom, "really concerned for the honour of the coal, "and as I reckoned the subject my own, I wished therefore to be its faithful historian."

Memorandum on the usual Building Materials of the district of Cuttack, forwarded to the Museum of Economic Geology, with a set of Specimens. By Lieut. RIGBY, Executive Engineer, Cuttack Division.

No. 1, called by the natives *Kondah*, found at Killah Mootree on the Mohanuddee, about ten miles above Cuttack, little Sandstone. used in the principal parts of buildings, but in constant demand for cornices and screen-work surrounding the roofs of the natives' houses. The stone is cut from the hills as wanted, and the simplest tools are used for that purpose, small or large chisels, according to the size of the portion to be separated. The operation is slow and laborious, and its cost is about three and half annas per yard. The yard of stone is three cubic feet; the carriage per yard to Cuttack is one and half annas.

No. 2, (*Laterite*,) called by the natives *Makrah*, used almost entirely for puckah buildings in this district; and may be had in almost every place, as it is found over a large extent of country, and may be carried in the rains to any part of the district. It is procurable in this presidency over a line of about sixty miles, running South-west from Cuttack, and is, I have no doubt, found over even a greater length in the Madras presidency. It is cut in slabs of from one to four feet in length, and to two feet in breadth, but seldom more than eight or nine inches in thickness, and is only quarried to a depth of two or three feet from the surface, as below that it is too soft for use. The mode of quarrying is simple; a channel being cut to the depth wanted, the stone is split off with a few blows of the hammer and chisel. Exposure to the atmosphere appears to harden these materials.

No. 3, called *Bolemallah*, is used for the same purposes as No. 1. Brought from the Chutteah hills, Killah Durpon, Soft Argillaceous. cut at about four annas per yard; its carriage to Cuttack thence is, however, six annas for that quantity, which prohibits its use to so great an extent as No. 1.

I have been unable to discover where this kind, (No. 4,) called by the natives *Moogney* is quarried, as it comes to the Greenstone. bazar only from the old buildings in the district; it is, however, supposed to have been brought from some considerable distance to the Southward. There is much of it in the Black pagoda,

and the images on many buildings are sculptured from it; its price is twelve rupees per yard.

Two kinds of lime are in use in this district. The one made from shells, (Specimen, No. 5,) collected on the coast about Manickpatum, the other from *konker*, (No. 6,) found in numerous rivers in this district, but principally in Debnuddee. The former is collected at an expence of about three rupees and four annas per hundred maunds, and its cost when burnt, is about fifty rupees the hundred maunds, where the shells have to be carried a distance of eight or ten miles. The *konker* is collected at the rate of two rupees, and its carriage to Cuttack is six rupees for that quantity; when burnt, the lime stands at from seventeen to eighteen rupees the hundred maunds.

The foregoing are the principal building materials in use in this district, for bricks are little used, as the generality of the soil is unsuited to their manufacture:—

Specimens of Iron.

Iron, of the three kinds sent is procurable in the bazar in any quantity. The ore is found in the direction of the Mahanuddee river, a considerable distance (about 150 miles) above Cuttack, and is smelted there. The cost of No. 1, per Cuttack maund (150 sa.) is five rupees and eight annas; of No. 2, four rupees and four annas; and of No. 3, three rupees and twelve annas.

Specimens of Timbers procurable in the Bazar.

Timbers of the several kinds subjoined come to Cuttack in the rainy season in large quantities; being floated down in rafts as soon as the Mahanuddee commences to rise. The average size of each, as it arrives, is shewn, as also the price, but Timbers of considerably longer scantling are to be procured in the forests whence these come.

No. 1.—Koorom Timber, length ten feet, and diameter at each end one foot three inches, cost of each one rupee and ten annas, received from Killah Ungool, river Mahanuddee, distance from Cuttack 100 miles.

No. 2.—Jack Timber, length eight feet, and diameter one foot, cost of ditto five rupees; ditto ditto ditto.

No. 3.—Ghamber Timber, length ten feet, and diameter one foot, cost of ditto four rupees; ditto ditto ditto.

No. 4.—Giringah Timber, the length ten feet, diameter nine inches, cost of ditto one rupee and eight annas; received from Killah Ungool, river Mahanuddee, distance from Cuttack 100 miles.

No. 5.—Ubloos Timber, length ten feet, diameter one foot, cost of ditto five rupees; ditto ditto ditto.

No. 6.—Saul Timber, length ten feet, diameter one foot three inches, cost of ditto two rupees and eight annas; ditto ditto ditto, used as rafters.

No. 7.—Peahsaul Timber, length ten feet, diameter one foot, cost of ditto two rupees and eight annas; ditto ditto ditto.

This Timber is greatly in demand for doors, sash frames, and all kinds of furniture, &c. for which paint is used.

No. 8.—Sissoo Timber, the length ten feet, diameter one foot, cost of ditto three rupees and eight annas; ditto ditto ditto.

Takes a fine polish, and is much used for household furniture.

No. 9.—Boudhun Timber, length fourteen feet, diameter nine inches, cost of ditto three rupees and eight annas; ditto ditto ditto.

No. 10.—Kankarah Timber, length eight feet, diameter one foot, cost of ditto one rupee and twelve annas; ditto ditto ditto.

No. 11.—Dhamun Timber, length ten feet, diameter eight inches, cost of ditto one rupee four annas; ditto ditto ditto.

No. 12.—Saul Timber, Barohatty, length sixteen and half feet, and diameter seven inches, cost of ditto one rupee; used for beams, rafters, door posts, &c.

Second Report on the Tin of Mergui. By CAPT. G. B. TREMENHEERE, F. R. S., Executive Engineer, Tenasserim Division.

No. 3373.

From the Military Board.

TO THE HON'BLE W. W. BIRD, ESQ.

Deputy Governor of Bengal,

Fort William, 1st October, 1842.

HONORABLE SIR,—In continuation of our letter, No. 3403, dated the 16th October 1841, we have the honor to submit in original, Captain Tremenheere's letter, No. 183, dated the 27th August last, together with his second Report on the tin of Mergui, and to recommend that a copy of this Report, and also of the one forwarded with our letter above alluded to, with the specimens of tin, may be transmitted to the authorities in England, or to Professor Royle.

2d. The Superintending Engineer has reported to us, that he has received from Captain Tremenheere, three more boxes of specimens. These we have called for, and when received in this office, they shall also be forwarded to Government.

We have, &c.

(Signed) J. H. PATTON, *Chief Magistrate.*
 „ J. CHEAPE, *Lieutenant Colonel.*
 „ T. M. TAYLOR, *Lieutenant Colonel.*
 „ A. IRVINE, *Major.*

No. 183.

TO MAJOR R. FITZGERALD,

Superintending Engineer, South East Provinces, Fort William,

SIR,—I have the honor to forward by the H. C. Steamer *Enterprize*, my second report on the tin of the Mergui Province, and to advise you of the despatch by the same opportunity of three boxes of specimens, the contents of which are enumerated in the report.

2. I have also to report, that on my return from Mergui, I despatched by the Ship *Ann Ranken*, direct to London, a box of specimens

of the Kahan tin ore to Professor J. F. Royle, at the East India House, and forwarded by the Overland Mail to that gentleman a short account of the locality, and of the additional information I had collected on the subject on my second visit to Mergui.

3. Having consulted with Mr. Blundell, Commissioner, as to the best mode of disposing of the cleaned tin ore, which had been received from Kahan and another locality, he was of opinion, that as it is desirable the produce of the tin localities of the Mergui province should, as soon as possible, become known to English capitalists and adventurers, it would be useful to send the sample already collected, consisting of 229 viss, or 7 cwt. and 51 lbs. of ore from Yahmon, direct to the India House to Professor J. F. Royle, who will take the orders of the Honorable Court of Directors in regard to its eventual disposal. The quantity therefore, 12 cwt. and 38 lbs. in all, was shipped on the 11th instant on board the *Jupiter*, Captain T. Longridge, which has sailed for England direct. Mr. Sutherland, local agent of Messrs. Cockerell and Co., to whom this ship was consigned at this port, has most obligingly procured freight for ten boxes, containing the ore and specimens, on board the *Jupiter*, free from all charges.

I trust the Military Board will approve of the steps which have been taken.

4. In consequence of the inferiority of the Yahmon ore, its collection from that spot has been stopped by the Commissioner; but there are at present 118 viss of the Kahan ore at Moulmain, which await instructions, and more may be expected, as well as a sample of the Thabawlick tin, the most productive stream visited by me last year.

5. I beg to propose that this, as well as any further samples that may be procured, be sent in like manner to the India House, when Professor J. F. Royle will, with the consent of the Court, bring the subject to the notice of private speculators or others, who may be interested on the subject. The produce of the metal from the Kahan ore already sent, will, I should think, repay the expenses which Mr. Corbin, the Assistant Commissioner, has incurred in procuring it.

The report has been submitted to Mr. Blundell.

I have, &c.

(Signed) G. B. TRFMENHEERE,
Capt. Ex. Engr., Tenasserim Div.

P. S.—If it should be thought advisable to send a copy of the accompanying report to Professor Royle, it would afford better information than I was able to give in my hurried communication of May last, alluded to in the 2d para. of this letter.

(Signed) G. B. TREMENEERE, *Captain.*

Received from the Military Board by order of Government, for the Museum of Economic Geology of India.

Having in the 16th and 17th paragraphs of my first Report of the 31st August last directed attention to a rich deposit of Tin, existing at Kahan on the Tenasserim river, a few miles from Mergui, I have now to add the following information which has been since collected respecting this locality. Experimental operations have been in progress there since the end of April last, by order of the Commissioner, and under direction of Mr. Corbin, Assistant to the Commissioner at Mergui, with a view to ascertain the value of the spot for mining purposes, and I am happy to have it in my power to state, that these have been attended with complete success. More than eight hundred weight (8 cwt.) of clean ore of the pure peroxide of tin, ready for smelting has been collected by a gang of convicts, and was despatched from Mergui on the 18th July; this has been received at Moulmain, together with some bulky specimens from the same hill of maced crystals of tin or quartz, which in weight and in size of the crystals, surpass any thing I have seen in Cornwall or in Cabinets elsewhere.

2. In the early part of May, I proceeded to Mergui on the Steamer *Ganges*, and on the 10th of that month, visited Kahan in company with Mr. Blundell and Mr. Corbin. The survey of the hill, plan of which is forwarded herewith, was made on the following day. It will be seen therein, and by the portion of map on the same sheet copied from Capt. Lloyd's Survey of the Coast, that Kahan is one of several small detached hills upon what may be termed the Island of Mergui, formed by two branches of the Tenasserim, one of which debouches a few miles to the north of Mergui, and the other to the south, which is divided near the sea into numerous channels by flat mangrove ground. The general surface of the island itself is of level alluvial

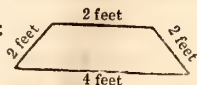
soil, from which these small isolated hills rise abruptly unconnected with each other, and detached entirely from the high granite and slate ranges which stretch along the peninsula. Except a small connected group at the town of Mergui, these have all the same exterior character, but Kahan is the only one in which tin has been found *in situ*. It occurs here imbedded in decomposed granite, consisting of a large proportion of felspar completely decomposed, termed kaolin or china clay, with quartz and mica, which appear to be its only constituents. A soft red sandstone is in immediate contact with the granite.

3. Along the same line of coast, in the southern part of the Malayan peninsula, in the provinces of Malacca and Johore for instance, the tin localities are similarly situated in small detached hills, having no apparent connection with the main ranges, and the ore is procured from a mixture of quartz, gravel, and china clay, which in description very much resembles the surface soils at Kahan. At Mergui, there is evidence of the destruction and denudation of granite hills, and of a considerable wash and deposit of debris from the eastward towards the Coast. The small cantonment there stands on the highest of a group, composed entirely of rounded fragments of quartz and sandstone, identical with that which touches the bed of decomposed granite at Kahan, with scales of mica, white felspathic clay, and likewise containing tin, which has been washed out of the gravels near the town, and from similar gravel hillocks in the neighbourhood which fringe the sea border. Localities of stream tin near the Coast south of the mouths of the Tenasserim are becoming known, and last year I penetrated to a range of hills about twenty miles from the Coast, consisting exclusively of granite, from the debris of which tin was obtained. I am for this reason inclined to think, that many of the small isolated hills before mentioned, as well as others in the low ground to the southward, will be found to consist, like Kahan, of nuclei of granite, containing tin, which have resisted the course of events, and have been left like islands in the alluvial plain between the high ranges and the sea.

4. The Kahan hill is 1921 yards in circuit at base, having a general direction of north-east and south-west; its highest points, C and F, are not more than 150 feet above the level of the surrounding rice fields.

There has been more abrasion, and the slope is more gradual on the eastern face of the hill than on the west; the debris on the east slope being evidently from the disintegration of the granite and adjoining sandstone rock, from which tin may at this day be plentifully procured a few feet below the surface. Some very rich specimens of the mineral were taken from a pit dug by the convicts about five feet deep at the point C in the plan. This face of the hill, as well as the north-east and south-west extremities near the base, have been dug into pits by the Burmese in former periods, and washed for tin in several places. Near the two last points, there are distinct traces of tanks which have been used for washing and separating the ore; the ground is seen there, and along the eastern slope, strewed with glittering plates of mica nearly an inch square, and covered with remains of the soft granitic matrix from which the ore has been extracted. A few persons now at Mergui were engaged here in tin works under the Burmese Government, and Mr. Corbin has ascertained from them, that those who understood the work, and laboured ten hours a day, collected one and a half viss of clean ore per man; but a very rich vein was not unfrequently met with, from which more than double that quantity could be obtained in the same time. No machinery was used, and the tin was procured by surface workings only. The produce, or clean peroxide of tin, was sold on the spot at the rate of five, or five and a half ticals of silver for ten viss of ore, which yielded on an average seventy per cent. of metal. The metal was at that period selling in the bazar at 100 ticals of silver for 100 viss of tin. There are 100 ticals in a viss, and 100 viss = 363 lbs. avoirdupois.

5. On arriving at Kahan, we found that the working party had reopened the bed of ore at the spot at which I found it last year, on the east face of the hill, marked A in the plan. At this spot, which is fifty-five feet above the level of the rice fields, and 600 feet horizontal distance from the foot of the slope, a pit twelve feet deep had been dug, the lower part of which was sufficiently roomy to allow a man to work easily with a pick-axe. The pit was an irregular four-sided figure of the following shape and dimensions: the three short sides being innermost next the vein, and apparently comprising its total thickness at that point, as far as could then be ascertained. All the three sides and the



entire depth of the pit consist of decomposed granite full of small bunches and strings of tin ore, of varying length and thickness, composed of crystals of the pure peroxide of tin, aggregated loosely together, and easily separable from the matrix in which it is imbedded. This is extremely soft and friable, and I was able with the sharp edge of a Burman *daw*, to cut down the sides of a pit, and expose fresh bunches of ore at every stroke. It is also remarkable for the large scales and crystals of mica it contains, the plates of which are readily separated, and for the abundance and whiteness of the kaolin or decomposed felspar of which the mass is chiefly composed, and to which the quartz appears to bear but a small proportion. Red sandstone touches this decomposed granite, and in the pit alluded to, looks like the enclosing rock of a vein, which is only slightly inclined from the vertical. A good sample of the ore had been collected here, and some rich specimens, shewing it in the matrix as taken from the pit.

6. The convicts had also been occupied in sinking pits near the base of the hill in other places, and had succeeded in obtaining at the north-east extremity, at the point C, some very rich specimens of the ore imbedded in material similar to that above-mentioned, angular as before, and apparently from another part of the vein, or very near it. This was afterwards placed beyond much question, for at the point B at the south-west extremity of the hill, and 280 feet from A, but on the reverse slope, the vein was again exposed to the day by a few hours' digging, and tin collected while we were there. This point is 43 feet above the level of the new fields on the west, at 550 feet horizontal distance from them, and the Burmese had worked there about 20 years ago, as was apparent by the washing tank situated on the level ground near it. It will be observed on the plan, that the points A, B, C, turn out to be in a direct line; A and B correspond very closely, both in substance and in elevation, and are doubtless part of the same vein, or mass of tin-bearing rock; and it seems probable, that this will be found to extend near the surface along the whole length of the hill, or 600 yards, accessible by mere pit digging, or by a straight gallery throughout its whole extent. It has been seen in thickness three and half feet, and in depth twelve feet; but its entire breadth and depth is, in the present stage of the workings, involved in some uncertainty, and can only be ascertained by mining operations systemati-

cally conducted. The upper decomposed portions of granite which have been exposed to view at the surface appear but indications of a most valuable repository of tin. The sandstone in contact with it is highly inclined to the horizon ; and holds no water, but this is procurable within three or four feet of the surface, at the base of the hill, and could be easily raised for washing the ore by means of a Chinese wheel, or by the chain and rag pump, or by any simple process. The hill itself is not ten minutes walk from the main river, and a tidal creek touches its south-west extremity near B, and another, the north-east, at C, by either of which the produce of a mine can be carried away at high water. The northernmost creek is accessible by large boats to within 300 yards of the base of the hill.

7. On June the 15th, Mr. Corbin writes, that two pits had been sunk to the depth of eighteen feet on the ridge to the left of the small pagoda, between the points B and A, in which the stratum was found to be very thick and rich in tin. A pit near the pagoda itself had been sunk to nearly the same depth, and a very good thick stratum of tin soil found. Another on the east face, half way down the slope from A, where work had been formerly carried on, had also produced some very good ore ; but as the ground had been much burrowed in former times, the surface soil was not very safe. Mr. Corbin on the above date, despatched to Moulmain eighty viss of the clean ore, which has been since received. On the 18th July, this gentleman informed me, that owing to heavy and incessant rain for fifteen or twenty days successively, the whole of the pits having no artificial support, had fallen in, before which however 170 viss more of cleaned ore had been collected, as well as the large specimens before alluded to. These are specimens of great weight and richness, consisting of large maced crystals of tin on quartz, and contain more tin in proportion to their bulk, than any specimens I have before seen. The largest which measured about fourteen inches square by twelve deep was so heavy, as to require some exertion to hold it steadily in both hands. Mr. Corbin had directed the whole of the upper soil at the pits on the ridge between B and A to be removed, and the convicts are still engaged in collecting tin from them. The stratum of tin soil, he says, is exceedingly thick here, he has ascertained it to be upwards of twelve feet. It is found, Mr. Corbin states, immediately "below the

sandstone rock, and consists principally of quartz and mica with apparently a small proportion of the sandstone, giving it a reddish colour: in some spots where the mica predominates it appears dark yellow; in this the ore is found scattered in masses; but lower down, it assumes the general form of whitish clay, where the ore is very little seen but in washing. The hill in this neighbourhood was in former days much burrowed, a pit with short galleries being met within a very few feet."

The following is a list of specimens accompanying this report, which are illustrative of the produce of Kahan:—

No. 1.—A box containing about twenty-one viss of clean ore of the native peroxide of tin.

No. 2.—Specimens of various sizes, not selected for their richness, but shewing the mode of occurrence of the tin ore in small strings and bunches, imbedded in the matrix of decomposed granite; some of these consist of nearly pure kaolin or soft felspar: in others mica and quartz predominate.

No. 3.—Specimens of pure kaolin, from the upper part of the excavations at A and B.

No. 4.—Specimens of macled crystals of peroxide of tin or quartz taken from a pit D, between B and A: with this several similar and larger pieces were found in the loose soil at the bottom of what was apparently an old Burmese shaft, and though Mr. Corbin writes, on the 9th of August, that no more had been met with, it appears from the extreme richness of the specimens, to be a valuable indication of what may be found at greater depths than have been hitherto penetrated. They existed probably in a cavity of the granite mass, before it was disintegrated by atmospheric causes, and wherein the large crystals of quartz and tin were deposited.

8. Ore rich in tin has now been found at seven different parts of the hill, chiefly in the line B A C, but near A, at more than 100 feet to the east of this direction; and Mr. Blundell, who has just returned from Mergui, informs me, that Mr. Corbin is pursuing his excavations to the westward of this line towards the highest part of the hill, and that the farther they proceed in this direction, the richer the ore becomes. This is scarcely, therefore, the character of a vein of ore, but may be more properly termed a bed of decomposed granite, containing tin in great abundance, in small bunches and strings throughout.

9. The mode of occurrence of the ore here more nearly resembles that of Banca, than any of which I am informed. The matrix in which tin is found at the latter, is said to be somewhat harder than that of Kahan, and to require pounding or stamping before it can be separated effectually; but the situation of the ores are, I understand, very similar. Mr. O'Reilly, a gentleman now residing at Amherst, was permitted by the Dutch authorities a few years ago to visit the Banca mines, and has described to me, that the matrix and ore are there dug out of pits in the face of a hill not 300 feet high, and that after being pounded, it is brought within the action of a stream of water, which is led from wells and a small spring on the higher levels. No machinery is used, but the Chinese miners penetrate after a time to a bed of solid silex, where the tin is lost altogether. Mr. O'Reilly has seen the specimens and samples of tin from Kahan, and pronounces them fully equal to Banca tin, and that the grain has precisely the grey glittering appearance, when held to the light, by which the Chinese miners distinguish good ores.

10. In addition to the sample of eight cwt. of clean ore collected at Kahan, 176 viss, or more than five cwt. have been received from near Yahmon, a conical and isolated hill in the Nunklai district, on the opposite or south side of the Tenasserim, and about a day's journey by water from Kahan, bearing south-south-east from Mergui, distant about twenty miles. The ore is found here as stream tin, in tidal creeks, about three miles from the hill, its colour darker than that of Kahan, being nearly black, which is caused by a mixture of Wolfram sand, or Tungstate of iron.

11. Of this locality, Mr. Corbin writes to Mr. Blundell on the 24th of April: "The following morning we proceeded from Kahan to Yahmon in the Nonklai district, where we arrived at 5 p. m., it having taken four and half hours hard pulling to get there from the Kywai Kuran village, and examined one of the localities, (that which had been worked during the Burmese Government); here the soil was rich in ore. The next morning we visited another place in a different Nullah, a short distance from the former, where also the tin appeared to abound; but the Chinese objected to the two last spots, in consequence of the want of a command of running water, for they make a decided objection to wash out the soil by hand. Of the three

“ places, they gave the preference to Kahan; one of their reasons in favor of this was, its propinquity to the town and the main river, for procuring their supplies. The tide flows to both of the Yahmon sites where the Nullahs appear to terminate, and during the spring tides the water recedes to a considerable distance from where I landed, leaving the Nullahs dry at this season; their sides are muddy, but in the middle is a small clear gravelly space in which tin ore is found. The Chinamen say, this ore is precisely of the same description as that of Kahan; but from the accounts of the natives, it always sold at ten per cent. less.”

This inferiority, which is marked by its selling price, is owing to the mixture of Wolfram sand, before mentioned, which, from being very nearly of the same specific gravity as tin, it is difficult to separate. It has likewise a strong sulphureous smell, and would require to be roasted before it is put in the smelting furnace. The presence of tungstate of iron with stream tin in the Mergui Province is very common; it has apparently an extensive distribution in some of the minor ranges near the sea, and becomes mixed with the tin in the beds of streams, after both are detached from their original sites. Nearly all the specimens of ore brought by Mr. Corbin last year from Malewan, on the Pakchan river, contain it in such abundance as would most likely interfere materially with the profitable working of tin in many of those localities. It was not present with the stream tin procured last year from the Thabawlick, the Thengdon, and other rivers east of the town of Tenasserim.

12. Two hundred viss of the Yahmon tin ore, in addition to what has been already mentioned, is expected by the next opportunity from Mergui; as well as a sample from the Thabawlick river, which I visited and reported on last year. Some Malays have been there collecting the ore, and have agreed to supply it at half the selling price of smelted tin, or about forty-five rupees per 100 viss.

An analysis of the Yahmon ore gave per cent.

Of Metallic Iron,	...	...	...	4.69
“ Tungstic Acid,	...	...	...	29.46
“ Sulphur,	...	...	...	1.37
Earthy residue and tin not examined...				64.48
				<hr/> 100.00

The Kahan ore gave on analysis 0.91 per cent. of metallic iron only, and is believed to be free from the tungstate of iron and sulphur.

13. No accurate statement can be made of the probable cost of obtaining the cleaned ore at Kahan from the outlay which has been lately incurred. Convicts alone, who were before quite unaccustomed to the work, have been employed, and for this labour no cost appears. Chinese labourers, who understand the process of washing and smelting are to be procured in any numbers, and many, who have heard that enquiries have been lately on foot concerning tin, have come already from Tacopah to Mergui in search of work. They arrive in poverty, and are glad to accept the wages of common coolies in plantation work, &c. till better employment is to be had. Advances of money for subsistence, and to enable them to make the requisite preparations for getting the ore, both in tools, wheel work, troughs, &c. are only necessary for commencing operations to any extent at Kahan, or at any of the most available sites of stream tin. The wages of Chinese miners in the peninsula are said to be from five to eight dollars per month; but they would be found ready to stipulate for the payment of their labour by a certain fixed proportion of the produce. At the Dutch mines, I am told they are remunerated by 40 per cent. of the actual produce, the remaining 60 being the clear profit and property of Government, which has been found at Banca and in the Straits to be the best mode of paying them. They are in mining operations, as well as in common labour, more skilful and industrious than any class in the East with which I am acquainted. By Rule 4th, concerning grants of waste forest and jungle land, published at Moulmain on 10th May 1841, a tax not exceeding 10 per cent. is leviable on the part of Government on the gross produce of mines worked within the limits of any grant.

The freight of tin from Mergui to Penang with the present craft, (China junks,) plying between the two places, would be two rupees four annas per 100 viss of 365 lbs. Freight from Penang to China by the Penang Price Current of April last, was 55 to 65 cents. per picul.

To Whampoa about 50 cents. more than to Lintin.

From Penang to Calcutta, eight annas to one rupee per picul.

” ” ” to Bombay ten annas to one rupee ditto.

” ” ” to London 1*l.* per ton of 20 cwt.

The freight of the metal from Mergui to London, via Penang, may be taken at *2s. 6d.* per cwt.

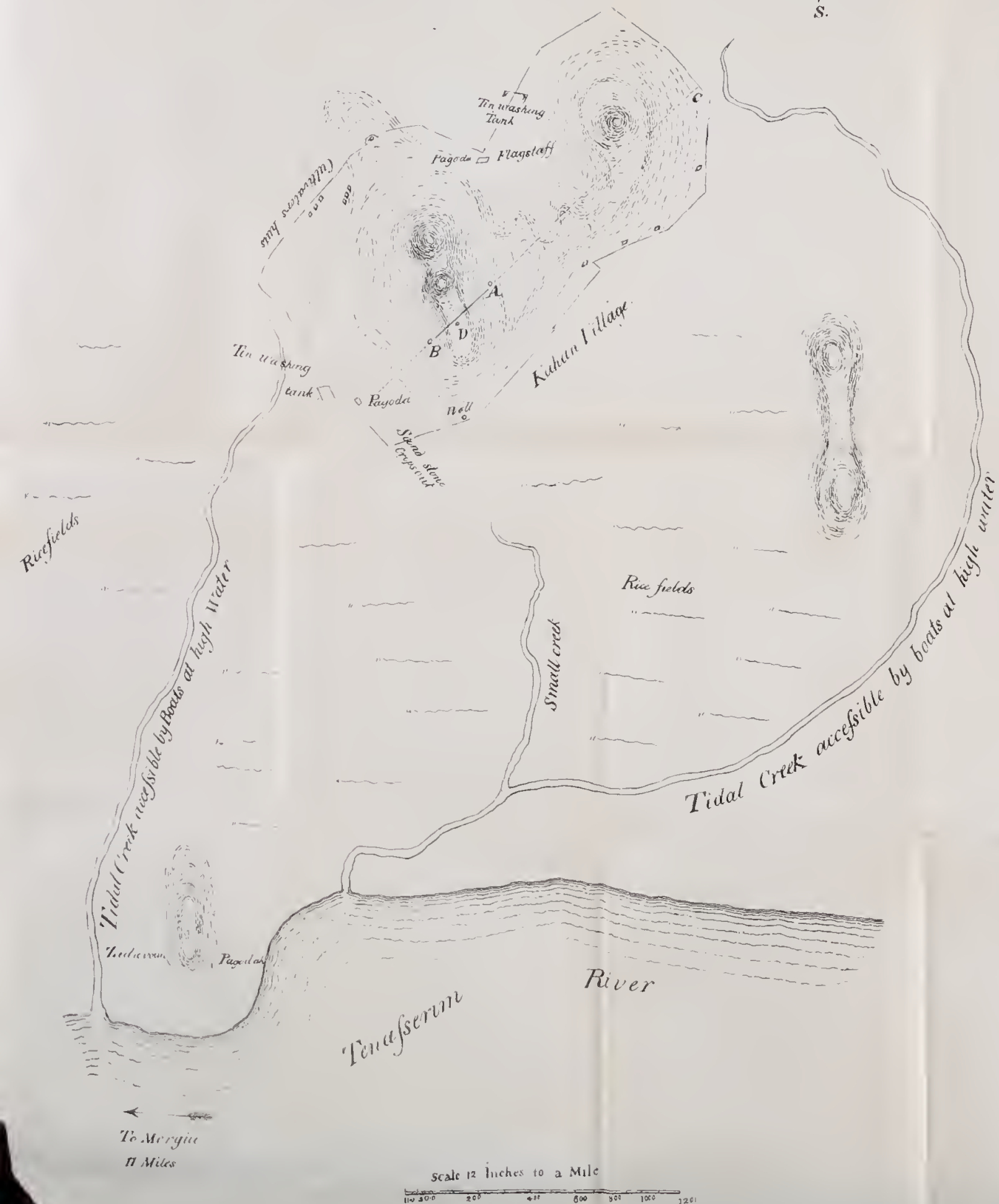
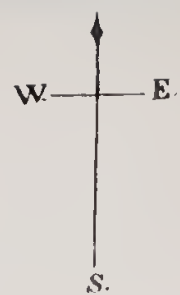
14. The annual produce of the Banca mines was stated by Sir S. Raffles in 1827, to be 30,000 piculs, but owing to the substitution of late years of Chinese workmen throughout, to whom the mines are farmed, for the less productive labour of the natives, the out-turn has been since nearly doubled. Mr. O'Reilly informs me that in 1841, the actual produce was 54,000 piculs, but a considerable reduction in the amount obtained from the Malayan peninsula, south of Junk Ceylon, has taken place within this period, chiefly owing to dissensions amongst the petty chiefs on the East coast. In 1835, 34,600 piculs were assigned by Ensign Newbold as the annual produce of these states, but the total amount from thence may now, I understand, be estimated at about 22,000 piculs,—and from Banca

54,000

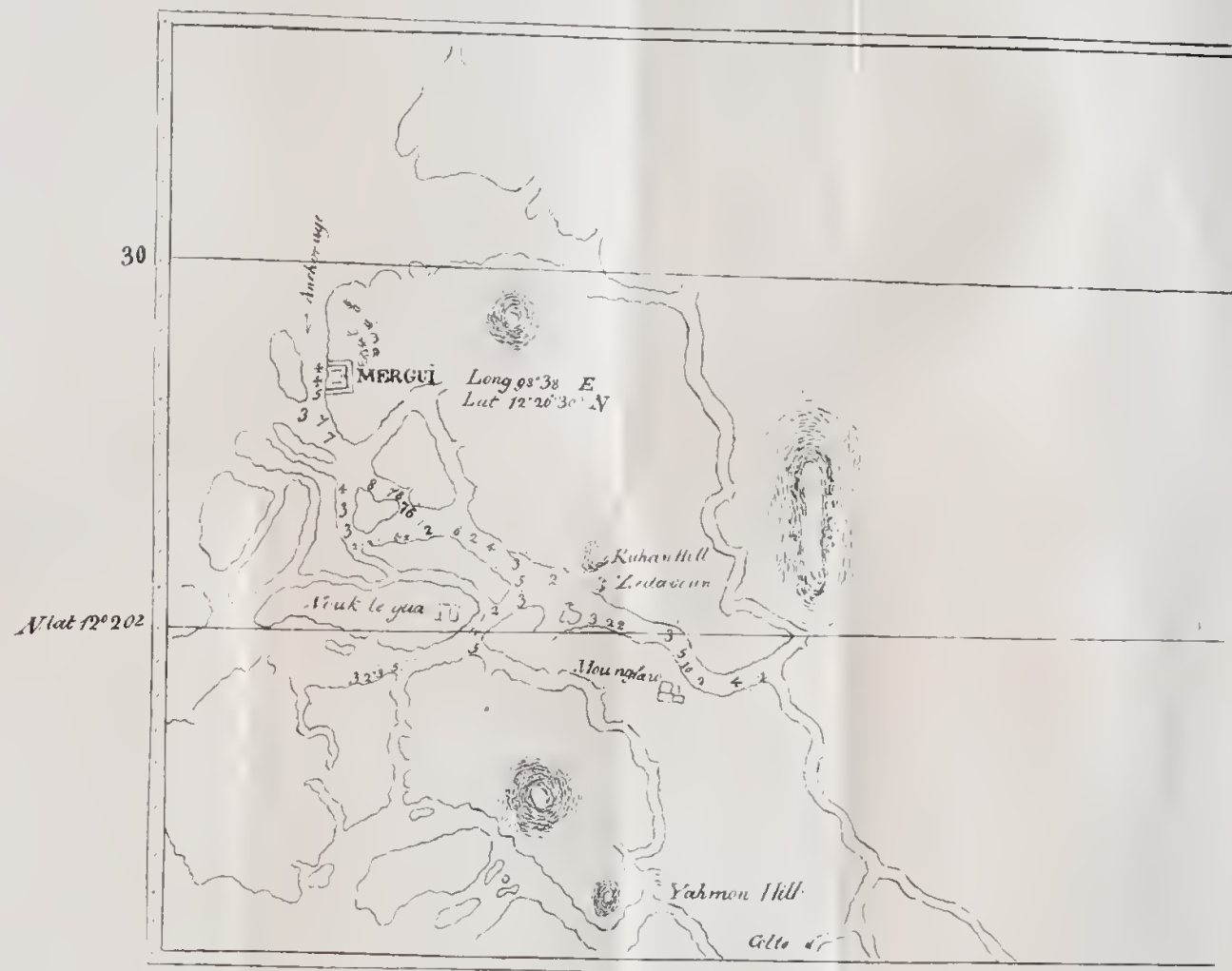
76,000 piculs, or 4523 tons.

In this most extensive tin region, comprising the whole of the Malayan peninsula, the most extensive known repository of this metal, there is sufficient evidence collected that many convenient and valuable localities exist within the limits of our own territory. The northernmost point at which it is known in the Tenasserim Provinces is amongst the high ranges near Tavoy, where, in the Tounq-byouk valley, it has been seen by the Rev. Mr. Mason, and traces of former works observed above Kaboung and on the Talinguwa, twenty miles north of Tavoy. A specimen of very small grained tin from this locality has been recently brought from Tavoy by Mr. Blundell. It was washed out of alluvial soil, and stated to occur more plentifully, and sometimes in pieces at greater depths. The locality is said to be near granite hills, and from the occurrence of tin with the alluvial soils, it exists probably in great abundance in the hills themselves. To the northward of this I have not heard of it, but in Kareenee, the country of the red Kareans, on the Burmese side of the Salween river in 18 north latitude, the metal has been obtained by Captain Warwick from the natives, at the rate of about twenty-five rupees per 100 viss, who states, that a considerable quantity of tin is obtainable there at that cost by indirect barter for beads, broad cloth,

Plan of the Kahan hill near Mergui
 Showing the position of the vein of Tin
 and its probable direction *BAC* May 1842.



From Captain Lloyds Survey
 Showing the relative situations of Mergui & Kahan
 distant by the river 11 Miles S.E.



and coloured cottons. It appears by a good specimen of rolled tin stone in the possession of a native at Mergui, which Mr. Blundell has shewn me, that near the head of the Palouk river, about thirty miles north of Mergui, tin ore exists, and the specimen exhibits tin interspersed in a rock very much resembling the ore of the Cornish mines. The existence of tin in the Palouk river was known, and the late Dr. Helfer proceeded on one occasion to examine it, but owing to indisposition, was obliged to return without effecting his purpose. Between the neighbourhood of Mergui and the Pakchou river, our southern boundary, it also occurs at Bokpyeen, and in many streams near the coast, but has not been much sought for, as this part of the province is an uninterrupted jungle, with scarcely any inhabitants.

15. All the tin sites in the Mergui province are believed to be healthy. Kahan is situated on the bank of a large river, where it is more than a mile broad, and a few miles only from the sea, while the spot itself is open, and the level ground entirely free from jungle. The coal mine lately worked on the Tenasserim river, sixty-four miles from Mergui, is farther inland than any of the tin localities yet known, and the country around is clothed with jungle to the summits of the highest hills; the parties of convicts employed there from December 1840 to October 1841, were not subjected to any remarkable degree of sickness, if their daily employment at hard labour, and consequent exposure, is taken into consideration. The European overseers and mechanics under Lieut. Hutchinson were perfectly healthy, and the following Table represents the proportion per cent. of native convicts reported sick at Mergui for nineteen months successively, compared with the proportion at the coal mine during the same period.

	Proportions per cent. reported sick during the month at Mergui.	Proportions per cent. reported sick during the month in the Jungles.	Remarks.
April, 1840.	$10\frac{5}{17}$	$24\frac{4}{15}$	1840. The number of convicts from which these proportions were determined, varied at Mergui, from 136 to 230, and in the Jungles from 94 to 204.
May, "	20	$21\frac{123}{137}$	"
June, "	$26\frac{6}{7}$	$27\frac{1}{137}$	"
July, "	20	$24\frac{2}{3}$	"
August, "	$15\frac{35}{61}$	$12\frac{16}{57}$	"
September, "	$11\frac{1}{59}$	$27\frac{87}{89}$	"
October, "	$11\frac{25}{31}$	$18\frac{1}{2}$	"
November, "	$14\frac{11}{81}$	$28\frac{34}{97}$	"
December, "	$16\frac{4}{37}$	$35\frac{75}{61}$	"
January, 1841.	$6\frac{15}{74}$	$11\frac{167}{753}$	1841
February, "	$3\frac{59}{417}$	$16\frac{1}{2}$	"
March, "	$9\frac{43}{73}$	$16\frac{16}{49}$	"
April, "	$7\frac{27}{39}$	$26\frac{182}{192}$	"
May, "	$8\frac{13}{39}$	20	"
June, "	$14\frac{21}{147}$	$27\frac{6}{47}$	"
July, "	$7\frac{39}{73}$	$9\frac{99}{189}$	"
August, "	$9\frac{3}{8}$	$16\frac{8}{37}$	"
September, "	$13\frac{53}{219}$	$8\frac{76}{103}$	"
October, "	$8\frac{16}{33}$	$6\frac{18}{47}$	"

The receipts of tin ore up to this date are,

From Kahan, corresponding with sample, No. 1.	
" despatched from Mergui, 15th June	80 viss
" ditto ditto 18th July	177 "
" ditto from Mergui 17th Augt.	118 "

Total, 375 viss or 12 cwt. 24lb.

From Yahmon, corresponding with sample, No. 2	
" despatched from Mergui 18th July	166 viss or 5 cwt. 15lb

Total from both places, 541 viss or 17 cwt. 69lb

MOULMEIN,
27th August, 1842.

(True copies,)

(Signed) G. B. TREMENHEERE,
Capt. Bengal Engr. Ex. Engr. Ten. Div.
H. V. BAYLEY,

Depy. Secy. to the Govt. of Bengal.

We have lost no time in giving this valuable report and its plan to the public, and we should add here, that the specimens have been divided; a part having been sent home to the Hon'ble the Court of Directors, and a part retained for the Museum of Economic Geology.—Ed.

Notes on the Iron of the Kasia Hills, for the Museum of Economic Geology. By Lieutenant YULE, Engineers.

We have had much pleasure in giving with this valuable article, (not the last we trust that the Museum will be favoured with from Lieutenant Yule,) the spirited sketch, No. I. which accompanied it, but No. II. was found to be exactly similar to that accompanying Mr. Cracroft's paper on the smelting of the Iron Ores of the Kasia Hills, in *Journal As. Soc.* Vol. I. p. 150, and being rather graphic than of manufacturing utility, we take the liberty of referring our readers to that volume.—ED.

These notes are very imperfect, but having no prospect of opportunity to render them more complete, I am unwilling to withhold them, such as they are.

I believe iron ore is excavated at intervals throughout this great range of hills by all the various races who inhabit them, Garrows, Kassias, and Nagas, of many tribes.

The district in which these notes were taken, includes the large villages of Nongkrem and Moliem, near the banks of the Ka-umyam, or Boya Pani, about eighteen miles north of Cherra, and for a space five or six miles in length from east to west by two in breadth, exhibits old or new excavations in every hill-side. So marked an effect have these works achieved on the undulating hills which cover the country, that in many instances what must once have been like their neighbours, round, swelling knolls, appear to have collapsed and sunk to their skeletons, shewing nothing but fantastic piles of naked boulders; the earth which once bound and covered them, having been entirely washed out by the heavy rains following in the track of the miner. So numerous and extensive are the traces of former excavations, that judging by the number at present in progress, one may guess them to have occupied the population for twenty centuries. The mines are so similar, that the description of one will sufficiently apply to all. It presents to view a semi-circular

See Sketch A. broken slope of debris and boulder, on the hill side, exactly such as is described by the word *scar* used in the north country at home. A small stream of water is conducted along the slope to the site of the present

See ditto, b.

excavation. The excavators standing on one side of their work, poke out the soil from between the boulders with long poles terminating in iron spikes. The loosened soil tumbles into the stream, and is carried by it violently down a narrow channel to a point 200 yards distant, and about eighty feet perpendicularly below. Here a little post is fixed at each side of the stream, and against the upper side of these posts, little bits of stick are laid, so as to form a kind of dam, which stops the heavy particles of iron, whilst the lighter grains of soil are carried off by the rapid stream bounding over the obstacle. As the iron accumulates, sticks are added to heighten the dam, and when this is nearly as high as the bank, (about one foot), the ore, a fine black sand is taken out, the dam lowered, and the process repeated.

See Sketch C.
See ditto D. D.
Above the dam a man is constantly employed in turning up the channel of the stream with a hoe, to prevent the ore from sticking in the passage, and with a long hooked fork (F), he occasionally takes out any pieces of stone brought down by the current.

See ditto e.
The ore is now removed to the washing trough, which is supplied with water by a small branch of the upper stream.

See ditto G.
The washing is performed by two women, working the ore against the stream with their feet, and occasionally turning and mixing it with a hoe. It is then put in a heap to dry, and washed again. This washing I was told is repeated four times.

The ore is then carried to the smelting house. The charcoal used (at Nongkrem) is of all sorts. The best is said to be that made from a small species of oak common near the Boga Pani, and from a tree called by the Kasias *dingsai*, bearing an acorn, but the leaves of which do not resemble the oak. The fir is used, because it grows at the door, but it is not approved of.

The bellows are double; formed of two-half cylinders of cowskin, and worked by a man or woman, with a leg on each swaying from foot to foot. Sometimes this employs two, as in the sketch, where the good man and his wife are at work. The furnace is about twenty inches in diameter; and the chimney about five feet high, made of clay bound with iron hoops. In the village of Sorra Rim, the chimneys

are made of a fine white clay, a quantity of which was furnished to Dr. O'Shaughnessy for his experiments in Pottery.

The iron sand is wetted and placed on a shelf. At short intervals a handful of fern leaves is dipped into the sand, and shoved into the furnace, and charcoal to replenish the fire is poured down the chimney. In some villages, instead of using the fern, as above described, the ore is mixed with pounded charcoal and placed on the shelf. The person who works the bellows, at almost every other sway of his body takes up a pinch of the mixture, with a long handled spoon, and drops it into the chimney.

After an interval (which from the equal size of the masses, must be very regular, though judged by guess,) one of the workmen stirs up the mass with the poker (M), takes it out with the tongs (N), lays it on a block covered with earth, beats it with a wooden club into a sort of hemisphere, and then splits it nearly in twain with axe (O), which like most other Kasia cutting and digging tools, has a heavy-headed handle and a very acute angle. He opens the split further by the insertion of a couple of wedges, and then pitches the hot mass (P) into a trough full of pounded dross, to cool. The metal, impure as it is, is now sent to market all over the hills, and to the plains of Sylhet. The loss of iron purchased in this form is at least three parts in four. Heating in the furnace and hammering, form the only further process of purification.

The Kasia tools appear generally to be of impure iron, though their edges are often good and serviceable, being formed of steel, and welded to the rough blade. The Nagas to the eastward, though said to be much more savage in their habits than the Kasias, appear (judging from their weapons of war) to have much more skill in refining iron. The excavation is only carried on in the height of the rains, as the streams employed in their plan of washing the iron are only then full. Perhaps one year's excavation occupies only twenty days! and it may be still fewer, as the rain in that district does not come near the Cherra mark of thirty inches in twenty-four hours. From four to ten rupees annual rent is paid for a mine, where the proprietor is not the excavator. The men employed as miners receive four annas a day, and will excavate in twenty days in a good mine, the value of twenty five or thirty rupees each. Thus the statement of expense and profit in a good mine for a season of twenty days, will be as follows:—

Expenditure.

3 Men, (excavators,) at four annas for twenty days,	Rs.	15	0	0
2 Women, (washers,) at one and half do. for thirty days,		5	10	0
2 Lads employed in clearing the channel, and watching the dam D. at two annas for twenty days, .. .. .	.. .. .	5	0	0
Rent, .. .. .	.. .. .	10	0	0
		<hr/>		
		35	10	0

Profit.

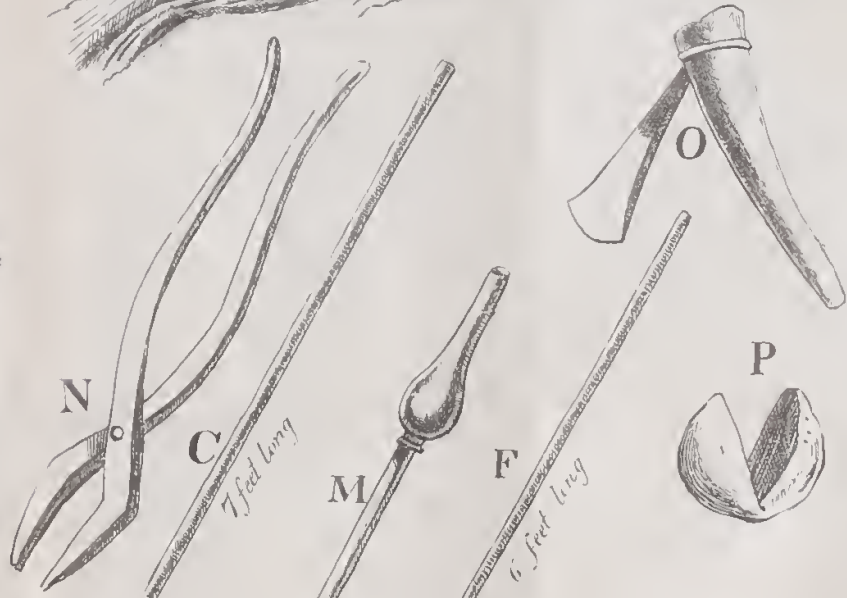
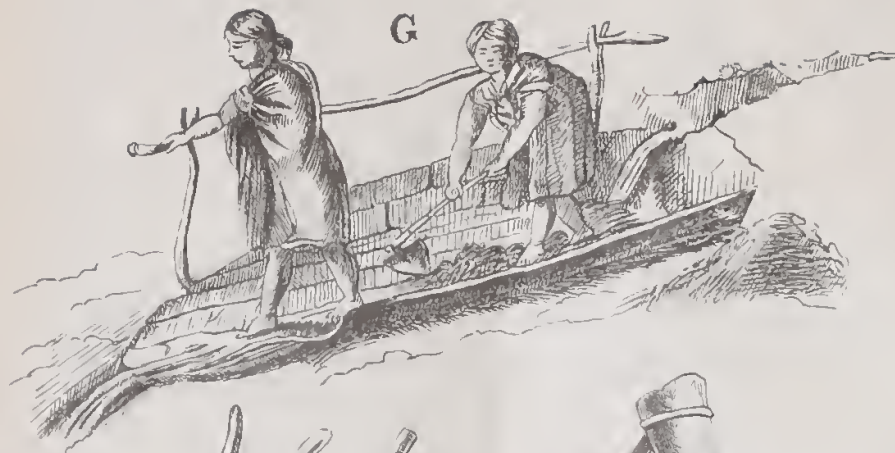
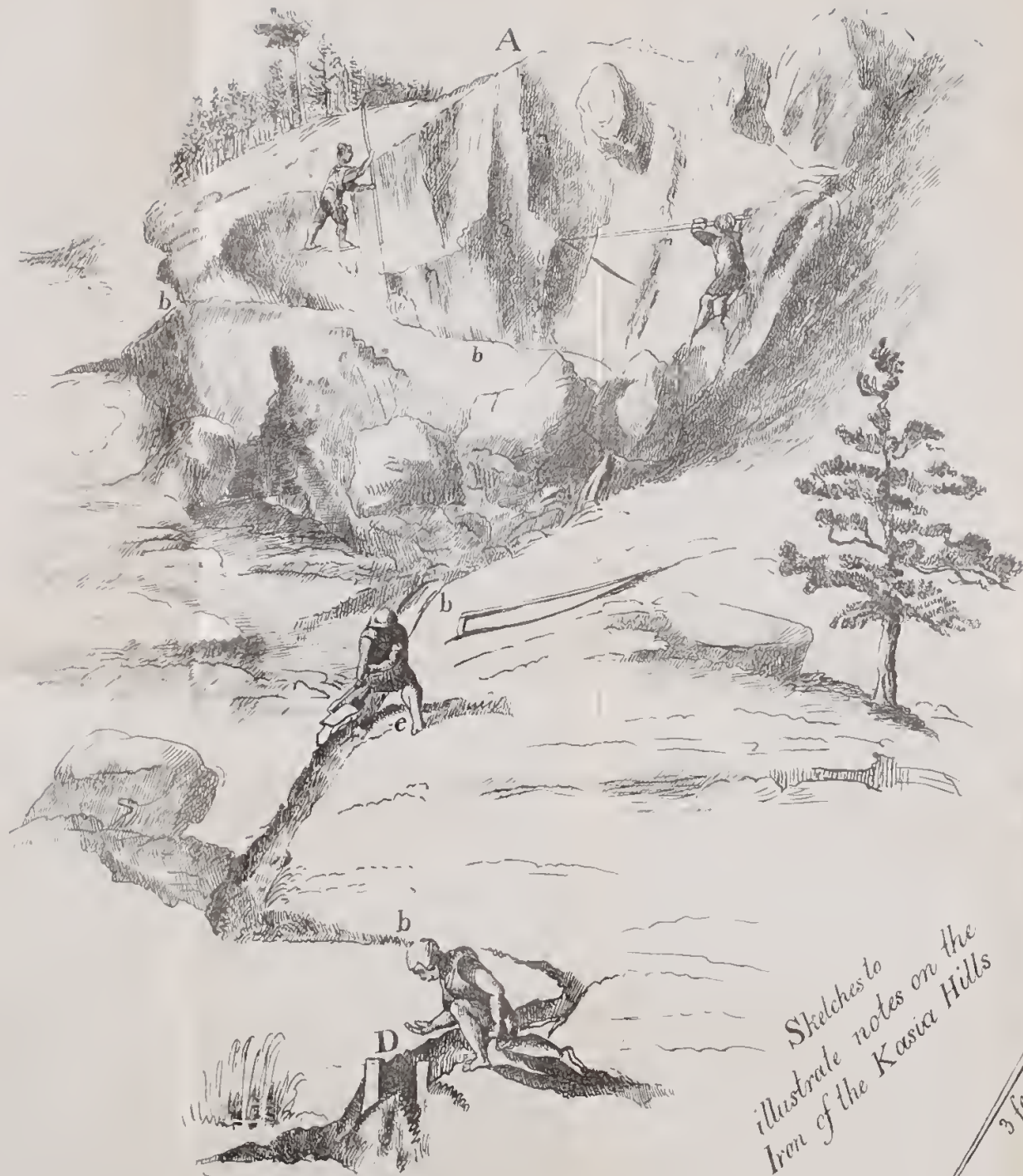
The work of three men, averaging a value of twenty-seven rupees each, .. .. .	.. .. .	81	0	0
Deduct, .. .. .	.. .. .	35	10	0
		<hr/>		
Profit annually, .. .. .	.. .. .	45	6	0

The ore when washed is sold for smelting by the basket, one rupee for seven baskets, or about three maunds.

After smelting, as above described, it is generally sold in the hills by the score of pieces. At Mongkrem one rupee, or one rupee two annas a score. About a dozen of these pieces go to the maund, and at the Pundua bazar, at the foot of the hills, they sell by weight at one rupee four annas a maund. Fourteen or fifteen of these pieces are made in one furnace in a day's work, or where the work is carried on day and night, as is common in some places, from twenty-four to twenty-five in the twenty-four hours. Specimen No. 6 shews the iron in this state. It is also sold in pigs, such as specimen No. 10, at three rupees four annas to three rupees eight annas in the Cherra bazar. Of this the smiths tell me, there will be a further waste of ten or fifteen seers in the maund.

List of Specimens forwarded.

- No. 1. Decomposed rock containing the ore.
- No. 2. Ditto in a more solid state.
- No. 3. Boulders in the ground excavated.
- No. 4. Ore partially washed.
- No. 5. Ditto ready for the furnace.
- No. 6. Metal after smelting as sent to market (half a piece.)



Sketches to illustrate notes on the Iron of the Kasica Hills

Drawn by L. Yule B.E.

No. 7, 8. Slags from the smelting.

No. 9. Dross detached by beating with wooden club.

No. 10. Metal as sold in pigs at three rupees eight annas a maund.

No. 11. Metal further refined.

No. 12. Is a specimen of slate found about twenty miles from Cherra near the Assam road. I should be glad to know any particulars of the proper mode of working and splitting slate,* and whether it is usually of better quality below the surface. This (found at the surface) does not split into plates sufficiently thin, nor sufficiently parallel.

There is, I am told, an account of the iron works in these hills by Mr. Cracroft, in an old number of the Asiatic Society's Journal. Not having access to the former volumes of the Journal, I cannot tell whether it is such as to render these notes superfluous.

Cherra Poonjee, 21st September 1842.

* This was duly sent.—H. P.

Note by the Curator Museum of Economic Geology.—The granite has nothing remarkable about it, and the iron sand is so minutely dispersed, that it can only be traced at times by a commencement of oxidation. The boulders are of silex.

The ore is composed of minute amorphous grains of the common iron sand, remarkably equal in size, and amongst which all traces of crystallisation have almost disappeared, for it is rare to detect any thing approaching to even an imperfect crystal. Upon digesting some of the slags with muriatic acid, I find that they contain sulphuret of iron (which accounts perhaps for the inferior quality of the metal) but no titanium was detected. Minute specks of the sulphuret resembling gold-coloured mica are visible on close examination in the granite.—H. P.

Captain THOS. HUTTON on GALEODES (vorax?)

In the 52d and 53d Numbers of the Annals and Magazine of Natural History, are two letters from Messrs. W. S. Macleay and W. E. Shuckard, relating to the occasional capture of small birds by certain species of Arachnidæ; and as the subject is one of some interest, I take the liberty of presenting you with a note long since made by me, on the habits of a large species of Galeodes, common to some parts of India, and for which, if undescribed, I would propose the name of "*Galeodes vorax.*"

My first observations on this species were made in 1832 at Mirzapore, where it is very abundant, and of large size. During the rainy season, it was my constant habit on a fine evening, to spread a sheet upon the ground near my house, upon which was placed a small lantern to attract insects.

In a very short time, two or three of these ravenous spiders would make their appearance at the edge of the sheet, but at a respectful distance from each other, and no sooner did a moth, or a beetle, or a cricket alight upon it, than it was snapped up and devoured before I could lay hold of it. There seemed indeed to be no end to the appetite of these creatures, for they continued to seize and devour every thing indiscriminately, that came within their reach, even to large and hard winged beetles, cutting them to pieces with their powerful jaws with the greatest ease. Many were the deadly fights I witnessed among these marauders, as they trespassed upon each other's beats to get possession of some newly alighted prey, and often was I obliged to kill them, in order that I too might in turn obtain some share of the booty. This species is, strictly speaking, nocturnal, though I have sometimes seen them active in the day time; they live beneath stones and in holes in the ground, and never construct a net or other trap for their prey, seizing every thing by main force, as they roam about in search of food.

Again I fell in with this species abundantly at Neemuch, where they were also sometimes of large size. One of these I kept for some time in a vessel, the bottom of which was well supplied with earth, which had been purposely hardened by pouring water on it and then allowing it to dry.

The *Galeodes* soon began to dig a hole, and in a very short time succeeded in making itself a subterranean retreat, in which it usually resided, seldom coming forth beyond the mouth of its den. It proceeded to dig out the earth at first with its strong jaws, cutting it away in a circle, and having thus loosened the soil, it gathered it together into a heap with its anterior palpi and threw it out behind, as a dog does in scratching a hole. When it had by this means succeeded in excavating a hole sufficiently large for it to enter, instead of throwing out the loose earth as at first, it gathered a quantity together, and surrounding or embracing it with the anterior palpi, shoved the load

by main force before it up the mouth of the cave, and then returned for more. Having completed its task, it remained for a few days stationary and refused to feed, although previously it would devour several insects at a meal, and even small house lizards. I now perceived that it was a female, the ova being distinctly visible through the skin of the abdomen, which was much distended.

The ova were deposited in the cave, to the number of more than fifty (50,) the parent remaining motionless amidst them. In the course of a fortnight, these, which were of the size of a largish mustard seed, and of whitish hue, were all hatched.

The young are at first motionless, and appear devoid of animation until the period of three weeks has elapsed, at which time they cast the first skin. Their colour, which up to this time was pure milky white, now gave place to a faint tinge of pale brown, and the jaws and palpi became deep brown.

The young ones now threw off their lethargy, and began to move about and occasionally sallied forth from the den, but instantly retreated on the slightest appearance of danger. All this time, however, they took, apparently, no food whatever, and yet they continued to grow both in size and activity.

It was indeed very interesting to watch the motions of the parent at this season. From the general bad and ferocious character which the spider tribe bears, I fully expected to see the parent, at the first craving of appetite, commence an attack upon her own family, and devour them; but the all-wise Creator has endowed even this ferocious spider with that most powerful feeling—maternal love; and thus is the *Galeodes*, the very tiger of the insect world, subdued at this period into the anxious and tender mother. Placing herself in front of the aperture of the cave, she seized and examined between her anterior palpi, every thing that entered. I tried repeatedly to arouse her anger by thrusting in straws, hoping to make her forget her good behaviour, but all in vain, for though she bit and pulled at the straws in evident anger, not once did she turn upon her offspring, although crowding round and crawling over her very body. I then threw in some beetles and flies, upon which she vented her fury by speedily devouring them, and I thought by this means to play her a trick. Accordingly, I withdrew two or three of the young ones from the cave, and threw in alter-

nately a beetle and a young *Galeodes*, thinking to deceive the parent, and make her in the blindness of her fury, *commit infanticide*. But nature was not to be thus deceived; the unfortunate beetles were instantly seized and devoured, but the mother knew her offspring, and drew them into the den without the slightest injury; the beetles were gathered into her jaws, but her own offspring were merely seized between the anterior palpi, and allowed to pass on unhurt.

This whole family, much to my regret, effected their escape from the vessel in which I kept them, which being of glass and deep-sided, I thought sufficiently secure, and therefore left uncovered.

The *Galeodes*, however, being furnished with a *retractile sucker* at the ends of the anterior palpi, had contrived to crawl up the side of the glass, and make their escape. I succeeded more than a month afterwards in recapturing the old one in the same room, but her offspring I never again saw.

This species is extremely voracious, feeding at night upon beetles, flies, and even large lizards, and sometimes gorging itself to such a degree, as to render it almost unable to move.

A lizard three inches long, *exclusive of tail*, was entirely devoured; the spider sprung at it, and made a seizure immediately behind the shoulder, never quitting its hold until the whole was consumed. The poor lizard struggled violently at first, rolling over and over in its agony, but the spider kept firm hold, and gradually sawed away with its double jaws into the very entrails of its victim. The only parts uneaten were the jaws and part of the skin, although the lizard was at least five inches long from nose to extremity of tail. After this meal, the spider remained gorged and motionless for about a fortnight, being much swollen and distended.

A young sparrow, about half grown, was placed under a bell glass with a *Galeodes*; the moment the luckless bird moved, the spider seized him by the thigh, which he speedily sawed off, in spite of the sparrow's fluttering, and then as the poor bird continued to struggle in pain, the savage seized him by the throat, and soon put an end to his sufferings by cutting off the head. It *did not, however, devour the bird nor any part of it*, but seemed satisfied with having killed it.

On another occasion, I gave it a large garden lizard, which was instantly seized by the middle of the body; the lizard finding that

it could not shake off its adversary, turned its head and bit the Galeodes on one leg, which obliged it immediately to quit its hold and retreat; this was owing to the seizure having been made too low down on the body, for in general the Galeodes seizes as close behind the shoulder as can be, in order to put it out of the victim's power to turn and bite; the lizard was allowed to escape with only a severe wound in the side, but as it lived for some days before I allowed it to run off, the bite of the Galeodes would not appear to be poisonous.

On another occasion, my friend Dr. Baddeley confined one of these spiders in a wall-shade with two young musk rats, (*Sorex Indicus*), both of which were killed by it.

When two of these spiders are confined in a vessel together, both endeavour to make their escape, as if conscious of their mutual danger. If in their efforts to get away they are brought into contact, the one instantly seizes the other and devours him, the victim making no struggles whatever; but if they meet face to face, both enter into a wrestling match for life or death.

They plant their true feet firmly on the ground, the body at the same time being elevated, and the two pairs of palpi held out in front to ward off the attack. In this attitude they advance and retire, according as either gains a slight advantage, endeavouring to throw each other to one side, so as to expose some vulnerable part, or form an opening for attack, and when this is once effected, the fortunate wrestler instantly takes advantage of it, and rushing in, seizes his adversary behind the thorax, and the combat is ended; the vanquished victim yielding himself without further struggle to his inevitable fate.

The same species occurs in the Bhawulpore country, from whence I obtained it when constructing the road for the advance of the Army of the Indus in 1838. It is also abundant in Afghanistan, where in all probability it is the species mistaken by Elphinstone for the *Tarantula*, which he describes as common in that country, but which I neither saw nor heard of.

The usual size of an adult specimen of "*Galeodes (vorax)*," *mihi*, is about $2\frac{1}{2}$ to $2\frac{3}{4}$ inches long, and the body or abdomen equal to a thrush's egg. When in motion, the body is elevated off the ground, and the two pairs of palpi or feelers are stretched out ready to make a seizure; it progresses therefore solely upon the true legs, which

spring from the thorax, and are six in number. The head is armed with two strong and formidable chelæ, or double jaws, answering to the long cheliform fore-arms of the scorpion; these jaws are denticulate, and the ends are curved, sharp pointed, and extremely hard and horny, of a dark brown colour. Eyes two, and placed on the top of the head between the base of the jaws; the colour generally is sandy brown, and the body soft and clothed with short mouse-coloured hairs; the limbs, and especially the palpi, are furnished with long coarse hairs; beneath these are ten obtriangular plates springing from the under side of the thigh or coxæ of the posterior legs, five on each, the inner one being smallest, the outer one largest; these are of an obtriangular form, and their use appears to be still unknown. I never saw them used to assist progression in any way.

The true legs are furnished at the end with strong hooks or claws, but the two pairs of pedi-palpi are destitute of them, the anterior pair being the largest and strongest, and furnished at the end with a white retractile sucker; this in a state of rest is withdrawn into the last joint of the palpi, and it appears to be used to assist in climbing up surfaces, or in hanging against gravity, in the same way that flies and lizards use their feet, by the exclusion of air. In seizing its prey, one pair of jaws keeps hold, while the other is advanced to cut, and they thus alternately advance and hold till the victim is sawed in two; the only sound they emit is a hissing or rustling, caused by the friction of the two pairs of chelæ, as they are advanced and withdrawn; this is only heard when the spider is suddenly disturbed or irritated.

From the tenor of Mr. W. S. Macleay's remarks upon *Mygale* and the large species of *Epeira*, which he has discovered in the vicinity of Sydney, it would appear, that although these spiders may occasionally feed upon the juices of warm-blooded animals, which accident may throw in their way, yet that their natural food consists of insects, and the fact of their killing birds at all, must be regarded as a very rare exception to the general rule of their habits; and from the above remarks on *Galeodes*, it will be seen that the habits of this spider in some measure corroborate Mr. Macleay's opinion, for although strictly speaking, the proper food of *Galeodes* consists of insects, yet when accident throws a lizard in its way, it will not fail to seize and devour it. With regard however to its preying at all upon warm-blooded ani-

mals, we have as yet no testimony whatever, for in the experiments above cited it will be observed, that although the sparrow and musk rats were easily killed by the spider, yet that it fed upon neither of them.*

Mussoorree, 21st June, 1842.

* Should this paper meet the eye of Mr. Macleay, I may add, that I shall be happy to do my best in determining the habits and economy of any species found in my neighbourhood, if he will kindly point out his wants and wishes, and I shall likewise be happy to assist him with duplicates from my own collection. I would likewise gladly effect exchanges with any one collecting in the Islands, or on the Continent of India.

Proceedings of the Asiatic Society.

(Friday Evening, 12th August, 1842.)

The Hon'ble H. T. PRINSEP, President, in the Chair.

The following Gentlemen proposed as Members were unanimously elected; viz.

Captain R. SHORTREDE, Assistant Surveyor Grand Trigonometrical Survey.

Brevet Captain W. J. E. BOYS, 6th Regt. Light Cavalry.

R. HOUSTON, Esq. C. S.

Ordered—That the usual communication of their election be made to the parties, and that they be furnished with the rules of the Society for their guidance.

Messrs. J. MACKENZIE, and A. S. GLADSTONE were proposed as Members of the Society by the Hon'ble the President, seconded by the Secretary.

Library.

The following Books were presented.

Books received for the Meeting on the 13th August, 1842.

The Calcutta Literary Gleaner. Calcutta, August 1842. Vol. I, No. 4, from the Editor.

The Calcutta Christian Observer. August 1842. New Series, Vol. III, No. 32. Presented.

Abstract of the Proceedings of a Committee for the investigation of the Coal and Mineral Resources of India. Calcutta, April 1842. Two copies, from Government.

Reports on projected Canals in the Dehli Territory, Allahabad. From Government. Sixth report of the Egyptian Society, 1842, pamphlet. From the Society.

Laws and Regulations of the Egyptian Society, pamphlet. From the Society.
 The Annals and Magazine of Natural History, Vol. VIII. No. 53, Vol. IX, No. 56.
 Purchased.
 History of British Birds, by W. Yarrell. London, 1842, part 30. Purchased.

The Secretary submitted the proceedings of the Royal Society of Agriculture and of Commerce of Caen, received by the Mail.

Ordered—That the thanks of the Society be communicated for the same.

Read the following letter from Mr. PIDDINGTON.

TO H. TORRENS, ESQ.

Secretary, Asiatic Society.

SIR,—Having examined attentively the five books of Dr. Voysey's Notes, I beg to report, that there is in them much geological information of the very highest interest, for they principally relate to that stupendous geological phenomenon, the great trap and granite formation of Central India.

I have further to bring to your notice, that from a fragment of a report amongst the papers, it would appear that there must have been reports made by him to Government (the Supreme Government of India), from 1819 to 1824, apparently, at least, once a year.

I beg to suggest then that, as doubtless containing much matter of value, an application be made to Government for permission to examine and publish such parts of them as may be of general utility.

I am, Sir,

Your obedient servant.

Museum, 19th July, 1842.

H. PIDDINGTON,

Curator, Museum Economic Geology.

P.S.—I should perhaps remark here, that there are two *special* reports published in the Journal of the Asiatic Society for 1833; but these do not appear to me to be Dr. Voysey's official summaries of his annual labours, and from the fragment above alluded to, more I think must be found.

The Secretary, reported that the foregoing letter was, agreeably to the directions of the President, submitted to the Government, with a request that its Records may be searched for the highly valuable documents therein alluded to.

Read summary description of two new species of Flying Squirrels and of an Eagle, by H. B. HODGSON Esq. with observations by Mr. BLYTH, Curator.

Referred to the Secretary for publication in his Journal.

Read a letter from Capt. W. E. HAY, of the 1st European Light Infantry Regiment, noticing amongst other matters, that he had been the means of bringing before the public a number of new Coins, which Lieutenant CUNNINGHAM would notice in his forthcoming work on the successors of ALEXANDER the Great. In some instances circumstances had demanded his permitting them to pass into other hands,

which although a matter of regret, yet he still fortunately possessed a few that were supposed to be unique, and of great value.

Read letter from J. H. BATTEN Esq. of 10th July last, forwarding continuation of Major Manson's valuable Journal, with Lieutenant WELLER'S Notes, and promising by next opportunity, the Journal by Lieutenant WELLER, of the country beyond Oonta Dhoora, at the same time proposing Brevet Captain BOYS, 6th Cavalry, (with his consent,) as a member of the Society.

Captain BOYS was accordingly proposed in due form as a Member of the Asiatic Society, and the Journal referred to by Mr. BATTEN made over to the Secretary for publication in his Journal.

Read letter from Reverend J. H. PRATT, of 11th August 1842, on the brass Astro-labe from Herat, presented to the Society by Major E. POTTINGER, also made over to the Secretary for the Journal.

Read the following report from the Curator for the month of July, 1842 :—

SIR,—The most interesting recent accessions to our collection of vertebrated animals pertain to an important class, that of Reptiles, which hitherto I have been too much otherwise occupied to investigate except casually.

From Dr. Strong, we have been favored with a fine specimen, but just dead, of *Chelonia midas*; the Edible or Green Turtle, which has been mounted. It may be as well to remark, that this was not captured in the neighbouring Bay.

Having intimated a wish, not long ago, to possess some of the so called "Iguanas" that inhabit the tanks of the Botanic Garden, the Society has accordingly been kindly favoured by Mr. DeCruz, of that establishment, with three fine specimens, which have proved to be of as many different species. These it may be useful to Indian students of Natural History to describe.

1. *Varanus Bengalensis*, Dumeril and Bibron, in whose excellent 'Histoire des Reptiles', III, 480, will be found its synonymes. Length of the specimen (a female) forty-one inches, of which the tail measures twenty-four inches: head, to auditory orifice, three inches; to anterior margin of eye an inch and three-quarters; and the nostrils oblique, and situate half-way between the eye and tip of muzzle: entire length of fore-limb to end of middle claw five inches and three-quarters, and of hind limb, to end of claw of longest toe, seven inches and a half; the toes well developed, and claws, especially the anterior, very large and strong.* The head is covered with minute polygonal plates, nearly uniform in size, and the superorbital bone projects far over the eye: the nape is studded with scales of a rounded oval form, very much bulged, and each appearing like a nail set at the extremity of a digit; on the back this unguicular appearance is more strongly marked, the nail-like part being smaller,

* A very fine and bulky male, since procured in the same quarter, measured fifty-five inches in total length, of which the tail was thirty-one inches; from muzzle to auditory orifice three inches and a half; and length of hind-limb, to tip of the claw of longest toe, nine inches and a quarter: colouring exactly as in that above described.

and the scales flatter: on the fore-limbs anteriorly, the scales form hexagons, and are larger than elsewhere: the tail is clad with transverse series of oblong subquadrangular scales, those of its sides a little carinated, and the inferior scarcely exceeding them in size; along the ridge of the tail is a double serrated crest of laterally triangular scales, more strongly developed than in either of the following species: the under surface of the neck, breast, and inside of the limbs, are clad with rounded oval scales, and the belly with transverse series of others having an elongate subquadrangular form. The colour of this specimen is greenish olive-brown on the upper parts, very prettily and uniformly marbled with meandering lines of black scales, this black being nearly as broad as the intervals of ground-colour left between its courses: the head inclines to yellowish green, and has the black markings large and bolder; and the extremity of the tail is similar in hue, having the markings gradually fewer till they disappear: the under-parts are whitish, deeply tinged with yellowish-green on the neck, which is marbled as on the upper-parts, only that the lines are broken or not continuous; and the breast and belly are merely spotted with black, though the whitish scales are also minutely freckled with the same, the markings on the under surface of the tail being less defined. A constant character of this species is to have a black streak proceeding backward from the eye, which is broader and more developed than in the following species; and the toes have each a distinct yellow streak along their upper surface. Of various young *Varani* which we possess in spirits, there is only one which I incline to refer, with some hesitation, to the present species, the principal objection being that its claws do not appear to be proportionally large enough: the situation of the nostrils and proportion of the superorbital bones are, however, the same, and I can perceive no characteristic difference in the scaling; but the markings are more different, appearing on the upper parts of this one as irregular transverse series of pale yellowish-olive spots—each occupying three or four scales—on a dusky ground-tint, while beneath the colour is almost uniform yellowish, having transverse narrow dusky streaks on the throat and neck, and others extending downwards from the sides, but interrupted along the middle, where are only a few scattered specks; the under surface of the tail being altogether without markings.

2. *V. Picquotii*, Dumeril and Bibron. The specimen sent of this reptile, measures thirty-two inches in length, of which the tail is seventeen inches, being deficient of about an inch and a half of its extremity; from muzzle to orifice of ear is two inches and a half, and the nostrils are only half an inch distant from the former, being placed considerably more forward than in the preceding species; length of fore-limb to end of middle claw four inches and three-quarters, and of hind-limb to end of longest claw five inches and a quarter, the toes being comparatively very short, and the claws, especially the posterior, small for a *Varanus*. The head is covered with small polygonal plates, and the scales of the body are considerably larger than in either of the others, their form an elongate oval and much carinated, but becoming circular towards the occiput, where especially they are much larger than in the preceding species. The tail is more compressed towards its base than in *V. Bengalensis*, and also less attenuated or drawn out at the tip; the double serrature of its upper ridge is less strongly marked, and its scales are smaller and much narrower or more elongate, being also but little larger on its under surface than on the sides: those on the under part of the neck are nearly circular, becoming more oval towards and

upon the breast, while those of the belly are of the usual oblong-quadrangulate form. The general colour is yellowish olive-green above, irregularly banded with reddish-brown having dusky margins, which latter throw out lines across the greenish, so as to separate this into large round spots; these markings, however, are not very strikingly conspicuous: the tail is barred with successive pairs of transverse dusky bands, enclosing somewhat rufous brown interspaces; and the under-parts are pale and spotless, inclining much to yellowish-green on the belly, and having a few very faint dusky bars across the neck: above, the neck is uniform-brown, and the crown darker; there is a narrow streak of blackish behind each eye; the fore-limbs are sulphur-yellow, and the hinder coloured like the back and tail. Of several young which we possess in spirits, the largest measures nineteen inches, of which the tail is ten inches and a half; general colour similar to the last, but much paler, and legs green (the latter, however, may have faded), the dusky cross-bands underneath the neck are more distinct, the head and neck above are very pale, and the darker colour—though less deep than in the preceding—is more predominant on the back, so as to leave only a series of irregular whitish cross-bands. Another ten inches and three-quarters long, with the tail five inches and a half, is intermediate in its markings to the two preceding, but much darker than either; the cross-bars beneath its neck are very distinct, and there are others descending from the sides of the body, but interrupted along the middle of the under-parts, which lines are considerably less distinct in the last specimen, and but just visible in the large one. Still smaller examples, but six inches and three-quarters long, of which the tail measures three inches and a half, are more like the large one, but differ in having their markings well brought out and brightly contrasted: one has alternate broad and narrow cross-bands of pale greenish more or less divided into spots; and another has the same kind of bands less regular, both these having also the nape pale greenish, and banded with dusky-brown, which is broadest at the median line. It is clear that the particular markings of each individual specimen are permanent for life, as regards disposition, but become gradually indistinct, and more or less effaced, with age; the dark, which at first appear of uniform tint changing to brown where broad, leaving dusky edgings only; while different specimens vary at all ages considerably from each other, and are pale or dark, very probably according to the soil on which they inhabit.*

The *V. Picquotii* is remarkable for its comparatively short toes and small claws, and for the strong yellowish tinge which prevails more or less on its olive-green ground-tint. M. M. Dumeril and Bibron remark that they have every reason to believe that the *Monitor flavescens* figured by Hardwicke and Gray represents this species, although the scales are not shewn to be carinated, which, however, may have been an omission of the draughtsman; and accordingly they have included that denomination as a synonym, but without stating that the name *Picquotii* had been published prior to that of *flavescens*, which latter appears in the 'Zoological Journal,' III, 225. There certainly can be no doubt of the correctness of this identification.

3. *V. binotatus*, Dumeril and Bibron. The example sent of this species measures four feet and a quarter in length, of which the tail is thirty-one inches, thus exceed-

* I have since obtained other adults of this species, but none so large as that of which the dimensions are above given. They vary considerably in their markings, and in some the rufous brown colour predominates over the usually prevailing olive-green. In all the tribe, the colours of the living animal are much brought out by putting it into water.

ing, by more than half, the aggregate of the head, neck, and body : the head measures nearly four inches to auditory orifice, and two inches from eye to muzzle, the anterior margin of the nostrils being within half an inch of the tip of the latter : length of fore-limb to end of middle claw seven inches, and of hinder to end of longest claw nine inches ; the toes well developed, and furnished with large claws, though inferior in size to those of *V. Bengalensis*.* The head of this species is much more elongated than in either of the others, and has a curvilinear series of eight broad transverse scales above each orbit, conspicuously developed, while in the others the corresponding plates must be sought for to be observed : the auditory orifice is broad and open. The scales of the upper parts resemble those of the last species in form, being oval and much carinated, but their size is much smaller, especially upon the nape and towards the occiput ; on the sides of the tail they are small and oblong-quadrangulate, and on the under surface of the tail they are very much larger, a particular in which this species differs from both the preceding : they are of an oval shape upon the throat, breast, and inside of the limbs, inclining to circular on the latter ; and upon the belly they nearly resemble those of the under surface of the tail. This fine specimen has black scales with whitish intervals on the upper parts, and is banded across the body with several distant rows of white rings ; immediately behind the scapulars the first of these rows is less distinct, forming merely an obscure broad whitish band, anterior to which a broad longitudinal black streak proceeds backward from above each fore-limb, surmounted by a whitish one, not conspicuously developed in this specimen, but which is usually well marked, and from it is derived the specific name which the reptile bears ; the anterior limbs have a white spot on each scale, in addition to which the hind-limbs have scattered wholly white scales, imparting a speckled appearance : the under-parts are dull white, with incipient dark stripes from the sides of the body, and the throat and under surface of the neck are speckled with black, having besides a series of V-like cross-streaks pointing forwards ; tail minutely mottled black and whitish, with broad bars of the former, indistinct for the basal two-thirds, and the rest successively blacker to the end. Another specimen, of similar size, which we possess as a skin, differs only in having no markings underneath the neck, the black bands are less distinct on the tail, and the transverse rows of pale rings on the body less conspicuous : in this the lateral pale shoulder-streaks are but just visible, and varieties of this species have been met with altogether black. We do not possess examples of the young.

I kept the specimen of *V. binotatus* here described alive for some days, chained to a tree, which occasioned me to notice that it climbed the trunk with facility, and I also observed that its regular mode of defending itself was by slapping smartly with the tail, for which purpose it turned itself with the tail towards any one who annoyed it : but I make no doubt that, like other lizards, it would also bite if it had the opportunity, when the compressive force of its jaws would render its small teeth of some efficacy as a weapon.

A fourth Indian species of this genus already described, and which is common to Bengal, Siam, and the Malay countries, is the *V. nebulosus* of M. M. Dumeril

* The larger of two specimens since obtained, measured sixty-one inches in total length, of which the tail occupied thirty-four inches ; from muzzle to auditory orifice four inches and a half ; and length of hind-limb, to the tip of claw of longest toe, ten inches and three-quarters.

and Bibron; being stated to be one of those wherein the muzzle is most pointed. Accordingly, this is at once a distinction which separates from it a small specimen in the Society's Museum, which appears to be of an undescribed species, and I shall therefore venture to designate it *V. Bibronii*. It is remarkable for the great length of its tail, but in other respects is nearly allied to *V. Bengalensis*: its nasal apertures are situate as in that species, but the head is less flat, and a peculiar character consists in a group of central plates between the eyes, which are considerably less minute than the remainder of those upon the head. Length of the specimen twenty inches and a quarter, of which the tail measures thirteen inches, being very much drawn out at the end; at base it is perfectly cylindrical for about two inches, when the double serrated crest commences, which is not so strongly marked as in *V. Bengalensis*, the tail becoming thence more compressed to its extremity. General colour bright olive-brown, marked all over the body with longitudinal rows of alternately larger and smaller angular black spots; head tinged with yellow, and marked with a dark ring surrounding the group of larger scales between the eyes, behind which is a dark semi-circle pointing backwards, then another ring, flanked by a lateral black line along each side; the usual dark mark behind each eye, but narrow, and continued along the side of the neck; fore-limbs mottled with brown, olive, and yellow, having a streak of the last along each toe; the hind limbs and also the flanks shewing scattered pale yellow spots, which are surrounded by dusky-brown forming *ocelli*; tail indistinctly mottled, and yellowish for its terminal two-fifths, beneath, and the rest of the lower parts, also yellowish, irregularly marked with brown, the neck banded with dusky underneath, and between each of the bands a transverse row of spots. The specimen thus described is preserved in spirits: and I find that we have also a stuffed skin, which appears to be referrible to the same. This was received from Madras, and confiding in the judgment of an eminent Zoological acquaintance who has much studied the Indian *Reptilia*, I referred it to *V. binotatus* in my first Report to the Society. The length of this is twenty-three inches, of which the tail measures thirteen inches, but the neck is made rather longer than it ought to be. Colour above dusky brown-black, relieved with a few scattered inconspicuous whitish scales; beneath yellowish-white, mottled with spots and specks of dusky except under the tail, while the fore-neck is greyish and rather more densely mottled: the group of larger scales between the orbits is paler than the rest; and on the flanks and thighs are scattered ocelli as in the other specimen. I have little doubt that this is the species which I observed to be brought in considerable numbers to the bazar at Madras, being much eaten there by the natives; but I hope soon to receive some large specimens from that locality, which will determine the question. I certainly remember to have particularly noticed the great length of tail in the Madras species, by means of knotting which round the limbs the dealers disabled them from running away.

A species of *Varanus*, additional to those described in the very excellent work of M. M. Dumeril and Bibron, was obtained in the island of Mindanado by Mr. Cuming, and is described as *V. Cumingi* by Mr. Martin in *Proc. Zool. Soc.* for 1838, p. 69; and in the same work for 1831, p. 137, is a notice of the anatomy of a *Varanus* by the same author, which had lived for some time in London at the gardens of the Zoological Society.

By Mr. Piddington, we have been favored with a male specimen, and by our Secretary with a female, of an *Agama* common in the neighbourhood, appertaining to the subdivision *Calotes*, being probably the *C. Tiedmani*, Kaup, *Isis*, XX, t. 8, as quoted in Gray's *Synopsis Reptilium* appended to the 9th Volume of Griffith's *Animal Kingdom*, where the following synonymes are attached,—*Agama versicolor*, Daudin, t. 44, *A. flavigularis*, Daudin, and *A. Indica*, Gray. This species averages fifteen inches in length, whereof the tail exceeds eleven inches and a half; the longitudinal series of vertical scales forming its nuchal crest are tolerably elevated, those along the back are much smaller, and at the base of the tail they are nearly obsolete; there is also another series above each ear, divided into two groups, each of which has a single pointed scale longer than the rest. Colour changeable, but usually vivid-green, more or less tinged with yellowish, especially on the sides; beneath, whitish, the throat of the male often bright red: the markings also vary, but when well brought out consist of a row of large quadrangular spots along the back, changing from yellowish-brown more or less black-edged to wholly black, and a similar row along each side, between which and the former the ground-tint forms in some a pale band. The very long tail of this beautiful little animal is commonly raised to curve over the back. "It is the liveliest by far," remarks Mr. Torrens, "of the Lizard tribe that I ever saw: its motion is a most rapid darting run for from six to twelve yards, standing high on the fore-legs, and carrying its head singularly erect; it then comes to a dead stop, and remains motionless with the head erect for sometimes a minute and a half, when the rapid motion is resumed to be succeeded by a similar halt: it is very active, leaping from the ground upon shrubs, and its demeanour is markedly vivacious. This specimen I have watched for some weeks: it frequented a flower-pot opposite my dressing room, and seemed to harbour under a particular shrub."

Our Museum contains also a single example of a species closely allied, but nearly as large again, with the nuchal and dorsal crests more developed; this I presume to be *C. ophiomachus*, Kaup, v. *Lacerta calotes* of Seba and Linnæus, whereof the colour should be brilliant blue, but the fine tints of these animals wholly fade in specimens consigned to spirits.

From J. Baker Esq., Civil Surgeon of Noacolly (Bullooah), near Calcutta, has been received a species of *Trigonocephalus*, stated by him to be of rare occurrence, at least in this district. It appears to be nearly allied to *Tr. erythrurus*, Cantor, *P. Z. S.*, 1839, p. 31, (which also is indigenous to the Gangetic delta,) having the same number of abdominal plates and subcaudal *scutellæ*; but the tail has merely a very faint reddish tinge, and there is no black serrated line enclosing the abdominal plates. Length thirty-two inches, of which the tail, posterior to the vent, measures four inches and three quarters. Colour wholly dark grass-green above, beneath greenish white, the tint deepening towards the vent and along the under surface of the tail; sides of upper lip, and below ears, bluish; and wholly without markings, through the lateral row of scales bordering the abdominal plates are lighter-green than those above them, and may form a line more or less defined in younger specimens.

The only additional examples of this genus we possess consist of two small and probably young specimens, nearly allied to each other and to the above, and possessing the same number of abdominal plates. One, measuring twenty-three inches and a half, of which the tail is four inches and a half, and consequently longer in proportion than

that of the preceding species, is wholly of a leaden-blue colour above, with whitish under-parts; no lateral line; a remarkable (though probably merely individual) distinction consisting in four or five of the plates immediately anterior to the vent tending to assume the divided form of those of the tail, being in fact more or less divided and oblique. The other specimen is twenty inches and a half long, with tail four inches and a quarter; and is also leaden-blue above, and whitish gradually more suffused with blue for the first third of its under surface, the rest uniformly bluish and deepening to under the tail: it has also a narrow yellowish-white lateral line commencing under the eye and continued for its whole length. This is allied to the *Bodroo Pum* of Russell's 'Indian Serpents', plate IX., as indeed are the others also, and likewise to the *Tr. purpureo-maculatus* figured by Hardwicke and Gray.

From Dr. Thomson, who has already favored us with a highly interesting box of insects from Afghanistan, I have now to record the donations of a mounted human skeleton (that of an Englishman), excellently prepared and set up, and of an extensive collection of insects, filling 21 glass-fronted cases exceeding a foot square, and of which the contents of 18, consisting of the orders generally, were obtained in the vicinity of Agra, while the remaining 3 are filled with Himalayan *Lepidoptera*. This fine collection has arrived in most satisfactory condition, and constitutes, of course, a very important accession to our entomological cabinet, (the previous extent of which is briefly noticed at p. 604,) albeit a greater community of species occurs than would perhaps be anticipated in the entomology of the neighbourhoods of Agra and Calcutta.

Our esteemed contributor, Robt. Ince, Esq., has favored us with some specimens of a small Weevil known as the Mango Beetle, which prevails, as he informs us, "in the districts of Sylhet, Furreedpore, Dacca, Tipperah, Backergunge, and half Jessore—but strange to say, our own mangoes which, in 1835, I brought as grafts from Santipore, and planted in a pukka terrace with a wall round, are quite free from them; however, there is no accounting for them, for on enquiry it appears that frequently with two trees planted close to each other, the one has the insect and the other not." I have not the means of determining the genus of these insects which are found in all stages within the fruit of the Mango.

A fine Hawkmoth, of the genus *Sphinx*, has been presented to the Society by Mr. Borradaile. The only bird with which we have been favored since the last Meeting is a skin of *Cryptonyx coronatus*, from Captain Macleod.

In this class, I have also little to report on as concerns our own collecting. For a long while, in consequence of the heavy rains, not any were brought to the bazars, and the only rare species to the neighbourhood, which has been procured, is a fine male of *Oxylophus Coromandus*. Due progress has, however, been made in mounting our great accumulation of skins, and I have procured fine series of two species of *Euplectes* in addition to the common Weaver-bird, or *Eu. Phillipensis*. These do not appear to have been hitherto distinguished, and the females and young of both may be alluded to as *Eu. aurinotis* by Mr. Swainson, *Class. Birds*, II, 279.

Eu. Phillipensis, the common Baya or Weaver-bird of India generally, as also of the Malay countries, does not appear to attain its full colours until the third or fourth year. The young are like the females, and the once moulted males vary much in the intensity of the yellow colour upon the head, which in some attains its full brightness,

while others exhibit little more than a yellowish tinge; and there is also seldom any trace of yellow upon the breast at this age, beyond perhaps a feather or two, the rest being light rufous-fulvous, while the isolated yellow feathers alluded to are not new and indicative of a moult going on. In this state of plumage, great numbers may be now (June and July) purchased of the dealers, while no yellow-breasted specimen will be found among them; the latter, however, may be procured at the breeding assemblages, though only in a small proportion to the number of birds; and these again differ much in the quantity of yellow exhibited on their under-parts, it being perhaps not until the fourth or fifth year, varying in different individuals, that the full amount of this colour is thrown out. This species has its yellow paler and much less inclining to orange than in the others, which latter, too, are devoid of any upon the breast, and the female has no yellow lateral neckspot nor other trace of this colour, as occurs in both the other species.

Eu. Bengalensis; *Loxia Bengalensis*, Lin.: *Coccothraustes chrysocephala*, Vieillot: *Eu. albirostris* (?), Swainson. Length five inches and three-quarters, by nine inches and a quarter across; wing from bend two inches and three-quarters, and tail an inch and three-quarters. In all states of plumage this may be readily distinguished from the next species by the following characters;—the rump (and head and neck of the female and young) are not uniformly striated with the back and scapularies, but streakless, and the breast also is not marked with numerous longitudinal black streaks, but is uniform pale fulvous, with a broad black pectoral cross-band more or less developed; bill also more neatly formed, of a glaucous colour, *i. e.* bluish or pearly white in the adult male, whereas in the other it is deep black (as in *Eu. Phillipensis*). The mature male has the crown brilliant golden-yellow, with a slight inclination to flame-colour; back nearly streakless, and in one specimen dusky-blackish, while the rump is plain dingy grey-brown; a very broad black band crosses the breast, and the throat is white, and ear-coverts and sides of the neck suffused with dusky. Another specimen is generally paler, and has the throat, ear-coverts, and sides of the neck, pure white, with a tinge of yellow beneath each eye; the pectoral band is likewise interrupted in the middle, and considerably less broad than in the preceding. An old female has the pectoral band entire, but somewhat narrow; the crown streakless dusky-brown, slightly tinged with yellow; a bright yellow spot on each side of the neck, beyond the ear-coverts; superorbital streak of the same, paling towards the occiput, and throat deeply tinged with yellow, which forms a sort of moustache-streak on each side. Irides of all dark, and legs dusky flesh-colour. These are the only adults I have seen, among multitudes of the young in (presumed) second plumage. The latter were first brought to the bazar early in May, when great numbers were to be seen, all very similar, and such as I have kept alive from that time have as yet undergone no alteration: their feathers were worn, occasioning the black pectoral streak to appear conspicuously in all; whereas in another large quantity of these birds recently brought, and from among which I selected the adults, this pectoral streak was more or less concealed by terminal edgings to the feathers, of the same pale fulvous hue as the rest of the under parts: in other respects all resembled the adult female, but the newly moulted birds have generally the eye-streak, neck-spot, and throat of a brighter yellow, than when this plumage becomes worn: bill flesh-coloured. Dr. McClelland, to whom I shewed both this and the next species, is disposed to doubt whether either of them occurs in Bengal;

and whence the dealers are supplied with them I cannot satisfactorily assert, as they pass from hand to hand among them, and the statements of such people, concerning what they do not in the least interest themselves about, are not trustworthy. It is even a common practice with them to pass whatever they can off as Chinese, thereby, it would seem, thinking to enhance its marketable value.* However, there are specimens of the next species among those collected by the late Sir A. Burnes in the Western country; and Mr. Jerdon notices the present one, remarking, however, that he had not himself met with it, "but finds it recorded in Mr. Elliot's notes, as found occasionally in the Southern Mahratta country. That gentleman says that, 'the male has the yellow crown only in the breeding season. At other times only eye-brow and ear-spot are yellow. Their nests, though similar, are smaller than those of the common Baya, and have two chambers. Habits the same as those of the Baya.'" It will be seen that I differ in opinion from Mr. Elliot regarding the phases of plumage of these birds, which seem to depend on age and not on season.

Eu. striatus, nobis, n. s? Size of the last, or a trifle larger, having a black mesial stripe on each feather of the breast and flanks; the rump (and head and neck of the female) uniformly striated with the back and scapularies; neck, throat, and cheeks, of the male, dusky-black; and bill deep black, that of the female yellowish horn-colour. Crown of the male brilliant golden-yellow, and black generally predominates on the upper-parts, which are much more streaky than in the adults of the preceding species. The female is very similar to the young of *Eu. Bengalensis* in newly acquired second plumage, having the same yellow superorbital streak and neck-spot, more or less bright; and the under-parts are usually tinged with yellow, but are readily distinguished (like the crown and rump) by their streakiness. These birds have lately been sold in great numbers by the dealers, mingled with the preceding species, and it is remarkable that all of this kind have been in fully adult plumage, the males at least having the crown very brilliant yellow, as indeed have some of the young males of *Eu. Phillipensis*. It may be, therefore, that the mature plumage of this one is assumed at the first moult.†

I have the honor to be,

Sir,

Yours obediently,

ED. BLYTH.

Report of the Curator Museum Economic Geology, for the month of July 1842.

Museum Economic Geology.—We have to announce here the arrival of three boxes of specimens from England, procured for us by Captain Tremenheere. The letter accompanying them, of which copy is transmitted by Government, is as follows:—

* Great numbers of small birds are continually brought to Calcutta from Singapore, which taken hence to Europe, are there regarded as natives of this country; whereas, in truth, many of them do not inhabit this region.

† I have recently been assured that this species breeds abundantly in the reeds, margining some large tanks, a few miles to the southward of Calcutta; and that *Eu. Phillipensis* occasionally resorts to the same situations, in lieu of suspending its beautiful nests to the fronds of the fan-leaved palms, as is its usual habit. It is remarkable that the beak of *Eu. striatus* becomes gradually white after breeding, commencing at the base, but never bluish-glaucous like that of *Eu. Bengalensis*.

No. 141.

To J. H. YOUNG, Esq.

Deputy Secretary to the Government of Bengal.

SIR,—I have to acknowledge your letter No. 123 of the 12th ultimo, advising the receipt of three boxes addressed to me, to the care of Mr Phillips, Museum of Economic Geology, No. 6, Craig's Court, Charing Cross, London.

2nd. In reply, I beg to inform you, that these boxes contain specimens of metallic ores, or others, illustrative of metallurgical processes, which are intended for the Museum of Economic Geology, established in January 1841, in one of the rooms of the Asiatic Society at Calcutta.

3rd. The Specimens in question, form part of a Collection designed to aid in the development of the mineral resources of India, the first portion of which was brought out by me at the period above-mentioned, under sanction of the Honourable Court of Directors. For its progressive increase, I arranged, before leaving England, with Sir H. T. De la Beche, F.R.S., &c. &c. Director of the Museum of Economic Geology in the Department of Her Majesty's Woods and Forests, for the occasional transmission and interchange of specimens of mineral products. I was likewise promised by gentlemen, connected with mines and manufactures in Cornwall, Northumberland, and Wales, several series of specimens suited to the objects in view.

4th. It was arranged that these boxes of specimens, when ready, should be forwarded to the care of the Curator, Mr. Phillips, of the London Museum of Economic Geology, from whence they were to be forwarded to Calcutta by the proper authorities at the India House, who had instructions from the Court of Directors to that effect.

5th. Any boxes therefore that may in future arrive, addressed in a similar manner to those which are the subject of this letter, may, unless marked "Private," be transferred at once to the Government Museum of Economic Geology at the rooms of the Asiatic Society.

I have the honor to be &c.

(Signed,) G. B. TREMENHEERE, *Captain,*
Executive Engr. Tenasserim Provs.

Revenue Department, the 20th June, 1842.

(A true Copy.)

FRED. JAS. HALLIDAY,
Secretary to the Govt. of Bengal.

MOULMAIN, 19th April, 1842.

The contents of the boxes are as follows:—

One box ores of copper, &c. copper and tin with other minerals as fluor spar, &c. indicating the modes of occurrence of the ore in the veins.

One box larger specimens, mostly duplicates of the foregoing.

One box coal, from the Newcastle coal-field.

We have also received from Major Ouseley, Agent to the Governor General, N. W. frontier, specimens of gold and gold dust from the Brahminy river;

Specimens of Garnets from the Bora Sambur, a tributary from the South to the Mahanuddee;

And of an ore of lead and antimony, with the matrix in which it occurs from near Hazareebaugh.

The last mineral is under examination, and will be duly reported on.

From J. H. Batten, Esq. C. S. an assortment of ores of iron, copper, lead, &c. from Kemaon, have just arrived while I am writing. These will also be noticed in more detail in the next report.

Geology and Mineralogy.—I have the pleasure of congratulating the Society upon the recovery of Captain Herbert's Geological Map, as will appear from the following letter, in reply to that addressed by our Secretary to Government.

No. 582.

To H. TORRENS, Esq.

Secretary to the Asiatic Society.

General Department.

SIR,—In reply to your letter dated the 1st instant, I am directed to acquaint you, for the information of the Committee of Papers of the Asiatic Society, that Captain Herbert's Geological Map, and the twelve colored Views of mountain scenery, referred to by the Committee, were forwarded to the India House, under date the 1st February 1827, and that an application will be made to the Hon'ble the Court of Directors for copies of the Map and Views, for preservation in the Asiatic Society's Rooms with the MS. Report recently recovered. I am, Sir,

Your obedient servant,

G. A. BUSHBY,

Secretary to the Government of India.

Council Chamber, the 20th July, 1842.

We have thus succeeded, I trust, in a public service of no small importance to the cause of science, which I doubt not will be fully appreciated by Geologists in Europe, to whom the remarkable phenomena presented by the formations of India, are of the very highest interest.

I am happy also in being able to announce, that there is every probability of the recovery of the Catalogue of Capt. Pemberton's valuable Bootan specimens, alluded to in a former report; for in a reply received from Capt. Blake, now at Sepree, who commanded the Escort, he describes so distinctly the book in which the notes were kept, that there is little doubt it will be found amongst his papers. General Macleod has again been written to on the subject, and I need not add, that we are certain of his most zealous assistance in all things. Capt. Blake's reply is as follows :—

Sepree, 7th July, 1842.

MY DEAR SIR,—I have had the pleasure to receive your letter of the 21st ultimo, regarding the Geological specimens handed to you by Col. McLeod. I extremely regret, that I have no clue whatever by which you would be able to assign localities to the different specimens. Pemberton used to put down in a note book (with a parchment cover which you may perhaps yet find) whenever he picked up, or broke off a specimen, its locality, numbered it, the dip of strata if we happened to be amongst stratified rocks, and whatever other information he thought useful. The loss of the book vexes me much, for my esteemed friend took an infinity of trouble to make every information regarding the unknown land of Bhootan as full as possible. I was hurried

away from Calcutta at so short a notice, that I had not time to fill in a Section of Bhootan, (which I had prepared on a large scale,) so as to shew the Geology throughout every mile. This outline I left with Pemberton, who gives it on a smaller scale in his printed report, but he *may* have filled up the one he got from me; if you have the luck to get it, much trouble will be saved you. In Pemberton's Report there is a Synoptical Table, showing, amongst other things, the Geology of every stage, which will enable you to lay out the specimens not far from the truth, but it is not of course altogether satisfactory. Regretting extremely my inability to give you the required information, I remain,

Very faithfully your's,

M. T. BLAKE.

I have been also engaged in examining five volumes of Dr. Voysey's Journals. My report on them is partly stated in my letter of the 19th instant, addressed to our Secretary, and with the approbation of the Honorable the President, Government has been addressed as therein recommended; and when I add that Dr. Voysey's whole time may be said to have been spent in crossing and recrossing the vast field of the trap formation from the Kistna to the Ganges, and from Cuttack to Bombay, noting day by day his acute and able remarks on it, it will be conceived with what interest these will be read in Europe, and how much they may contribute to advance our knowledge of the Geology of India. Our Secretary has authorised me to employ a Copyist for the purpose of extracting the geological and mineralogical details, (which require to be separated from various others with which they are mixed up) for the purpose of publication in the Journal, and I hope also to recover from our neglected stores, some of the series of specimens to which the Journal refers.

30th July, 1842.

H. PIDDINGTON,

Curator Museum Economic Geology.

For the contributions and presentations, the thanks of the Society were accorded.

Proceedings of the Asiatic Society.

(Friday Evening, 2d September, 1842.)

The Hon'ble H. T. PRINSEP, Esq. President, in the chair.

Messrs. JAMES MACKENZIE and A. S. GLADSTONE, proposed at the last Meeting, were ballotted for, and unanimously elected Members of the Society.

Ordered—That the usual communication of their election be made to Messrs. MACKENZIE and GLADSTONE, and that they be furnished with the rules of the Society for their guidance.

The Secretary submits in Persian and Oordoo MS. the work entitled "Tareekh-i-Nadree," proposed to be printed. The Secretary stated, that he had taken every care to procure the best MS. for collation. He had sent for the purpose to Lucknow, and had received thence, and from other parts of the country, nine MS. some of them having the character of great correctness. These MS. would be collated by Molvee Gholam Ukbar, Persian Librarian to the Society, with the aid of some native friends of the Secretary, who after careful perusal of the MS. produced by the collation, would submit it for approval to the Hon'ble the President. Ordered accordingly.

Ordered—That the Librarian of the Society be directed, with the aid of Readers, to prepare a List of the Readings of the Books, vol. 1 to 8.

Library.

The following Books were presented :—

Books received for the Library of the Asiatic Society, for the Meeting on the 2d Sept. 1842.

The Edinburgh New Philosophical Journal, by Professor Jameson, No. 64.

Edinburgh, 1842, from the Editor.

Minutes of the Committee of Council on Education. London, 1841, from Govt.

Reports on the training of Pauper Children. London, 1841, from Govt.

Naturalist's Library.—Ornithology, Vol. XII. British Birds. (Purchased.)

————.—Entomology, Vol. VII. Foreign Moths. (Ditto.)

Lyell's Principles of Geology, sixth edition. London, 1840, 3 vols. (Ditto.)

Merrat-ul-Janaun, Maroof Tarikh-ia-pha-i, 1 vol.

The Calcutta Literary Gleaner, Vol. I, No. VII. Sept. 1842, from the Editor.

Oriental Christian Spectator, June 1842, second series. Vol. 3d, No. 6, from the Editor.

Journal of the Bombay Branch of the Royal Asiatic Society, January 1842, No. 3, from the Society.

The Report of the British Association for the advancement of Science, for 1841.

London, 1842, one vol. from the Association.

The Trials of P. and M. Wallace. London, 1841, one vol. from A. ROGERS, Esq.

Yarrell's History of British Birds. London, 1842, Vol. III. pt. 29, purchased.

London, Edinburgh and Dublin Philosophical Magazine and Journal of Science.

Vol. XX, Nos. 129 and 131, purchased.

The Annals and Magazine of Natural History, Vol. IX, No. 57, purchased.

Royle on the Production of Isinglass along the Coast of India. London, 1842.

Two Copies, from the Author, P.

Hesyehii Glossographi discipulus. Edidit B. Kapitar. Vindobonæ, 1840.

Wilson's Translations of the Vishnu Purana. London, 1840, 1 vol. from the Author.

A Bengalee Pottée MS. from —

Read following letter from Professor WILSON of 2d July, 1842.

TO H. TORRENS, ESQ.

Secretary, Asiatic Society of Bengal.

East India House, 2d July, 1842.

DEAR SIR,

The Society will probably have been apprised by Messrs. Allan and Co. that the bust of Dr. Mill has been sent by them to Calcutta by my desire. I hope it will arrive in safety; it is one of the most successful of the late Sir T. Chantrey's works. The change from a picture to a bust, agreeably to the Society's instructions, involved an expence exceeding that for which provision had been originally made. £180 had been remitted by Mr. J. Prinsep to Messrs. Morris and Provost to await Dr. Mill's order, but Sir T. Chantrey's charge, as the Society is aware, was 200 guineas. I have paid the balance £30 to his executors, from the £200 in my hands on account of Mr. Prinsep's bust, as the whole sum will not I expect be required for the latter.

Little progress had been made in Mr. Prinsep's bust at the time of Sir T. Chantrey's death, and the executors were willing to transfer the model for completion to Mr. Weekes. I delayed, however, giving authority to Mr. Weekes to proceed until the model should have been seen by Sir E. Ryan and Mr. Wm. Prinsep, as they were expected in England. They have now seen the model, and suggested various alterations; and in fact, Mr. Weekes has made an entirely new model, under Mr. W. Prinsep's guidance. He and Sir Edward Ryan have both expressed their approbation of the model, and their favourable opinion of Mr. Weekes's talents, and I shall therefore direct him to complete the bust without delay. His terms are lower than Sir T. Chantrey's, and I hope therefore to be able to discharge them from the money of the Society in my hands, notwithstanding the deductions on account of the bust of Dr. Mill. There may be perhaps a surplus, and in that case it may be advisable to provide a set of Pedestals of Scagliola, or imitation marble, for the Society's busts; but for this I shall require further authority, as well as information of the height and diameter of the Pedestals, should the Society think it desirable to have them sent out.

I am, Dear Sir,

Yours truly,

H. H. WILSON.

The proposal of the Professor to provide a set of Pedestals of Scagliola, or imitation marble, for the Society's Busts, with the surplus fund in his hand was declined, pedestals having been already provided.

Read following letter from Captain R. WROUGHTON of 27th August, 1842:—

To the Secretary of the Asiatic Society, &c. &c. &c. Calcutta.

Chunar, 27th August, 1842.

DEAR SIR,

I beg to inform you, that I have placed under the care of Mr. Digney, proceeding to Calcutta, the three following specimens of Natural History, which, perhaps you

will do me the favor to present to the Museum of the Asiatic Society, in my name.

1st. The skin of a female Gour or Bison of the rocky forests, bounding the basaltic table land of the Nagpore State, and killed by my people near Umurkuntuk, the source of the Nerbudda river, in the month of April last.

2nd. The skin of a common Crocodile, killed near the Soane river, south of Mirzapoor.

3rd. The nest of a species of *Vespa Crabro*. This insect is indigenous to the forests of the basaltic table land confining the Nerbudda river at its source. I never saw the insect myself, because I only reached that part of the country in March last, at which time it appears, they usually leave their nests, and return to them at the commencement of the rains. I am in hopes I shall be able to secure and send to the Museum some of the Hornets preserved in spirits, and for which I have written.

By this time I had hoped that I should have been able to forward some other specimens of Natural History, peculiar to the interesting country about Umurkuntuk, but unfortunately the Rev. Mr. Loesch of the Berlin Mission, who located himself with five German artizans, near Umurkuntuk in March last, with the express object of winning over the wild "Goands," to settled habits, the useful arts, and the advantages of civilized life, and though last not least to the inestimable blessings of mental culture and pure religion; has, I grieve to say, with the whole of his companions been carried off by Cholera, which has for some months past been depopulating that country! Mr. Loesch and his friends promised me much assistance, which we are now deprived of.

It so happens, that the skins have been not only injured in the preparation, but otherwise by friction. I regret this, but accidents of the kind are unavoidable when quadrupeds or other large animals are skinned by ignorant people. In addition to this, the difficulty of conveying weighty specimens great distances over rugged and almost untraversed tracts, renders it impossible to pack them in such a way, as to preclude their injury during the transit from one place to another. I beg to subscribe myself,

Dear Sir,

Yours very faithfully,

ROBT. WROUGHTON,

Captain, 69th Regiment N. I.

Ordered—That Captain WROUGHTON be specially thanked for his contribution and exertions to furnish information.

Communicated by H. V. BAYLEY, Esq. a letter from Baboo Eshan Chunder Banerjea of the Hoogly College, forwarding a MS., being, as he presumed, a correct Genealogical History, in Sanscrit and Hindwi verses, of the Nagbongshus of Chota Nagpore, presented to the Baboo while at Kishenpore, by Lál Debnath Shahdeo, of Sehag.

The Secretary reported, that on the examination of the MS. by Dr. ROER and the Pundit of the Society, they were found to contain ge-

nealogical tables of the Nagbongohur, composed in the Hindee language, but written in Bengalee character.

Read the following report from the Curator, Mr. BLYTH:—

SIR,—Although the Ornithological department of our Museum may now be considered rich in examples of the species inhabiting Bengal and the Himalaya, it has hitherto been extremely deficient in specimens of those proper to Southern India; wherefore it is with much satisfaction that I now report on a fine collection of specimens from peninsular India, which has recently been presented to us by Mr. Jerdon, and which may be regarded as the first instalment of desiderata, from that quarter, which Mr. Jerdon is kindly endeavouring to procure for us,* whereof the value, too, is enhanced as verifying the actual species described or indicated by that naturalist in his "Catalogue of the Birds of the Peninsula of India," published in successive numbers of the 'Madras Journal of Literature and Science,' from XXIV to XXI^X inclusive.

Of Mammalia, are sent

* *Herpestes*† ———? A Mongoose from the Neilghierries, allied to (but certainly distinct from) Mr. Hodgson's *H. auropunctata*, *J. A. S. V.*, 235, identified by Mr. Ogilby as *H. Edwardsii*: this will shortly be described by Walter Elliot, Esq., the author of the excellent "Catalogue of Mammalia in the Southern Mahratta Country," published in the 'Madras Journal,' Nos. XXIV and XXV. It is also distinct from the allied Malayan *H. Javanica*, of which Mr. Elliot possesses a specimen, and as I can aver from recollection of the living *Javanica*.

* *Sciurus Delesserti*; lately figured and described, as Mr. Jerdon informs me, in the 'Magasin de Zoologie.' This animal is allied to the *Sc. insignis*, Horsfield, figured in the 'Zoological Researches in Java' of that naturalist, and also to another small species, from Bootan, in the Society's collection, which I presume to be undescribed, and shall therefore venture to designate *Sc. Pembertonii*.‡

* *Kemas hyllocrius*, Ogilby, *P. Z. S.* 1837, p. 81; a head with the skin on. I have been assured by Mr. Elliot that this, and no other, is the so-called Ibex of the Neilghierries, noticed by me in a letter published in the 'Proceedings of the Zoological Society' for 1841, p. 63: and as, according to that naturalist, its habits are quite those of a wild Goat, keeping to the steepest and most inaccessible situations, the term *hyllocrius* imposed by Mr. Ogilby, under the impression that this animal was the *Jungle Sheep* of Anglo-Indian sportsmen, becomes objectionable as applied to it. I have now been long satisfied that the so-termed *Jungle Sheep* of sportsmen refers to the Muntjac, Kakur, or Barking Deer, and a very intelligible description of the latter, as the *Jungle Sheep*, is given in a notice of certain of the Mammalia of the Tenasserim provinces, in the 'Bengal Sporting Magazine' for 1841, p. 445, which thus corroborates the information which I have received from other quarters. It is remarkable, however, that a rude figure of what certainly appears to be the *K. hyllocrius* is contained among the drawings of Gen. Hardwicke bequeathed to the

* A second large collection of bird-skins has since been received from the same gentleman.

† The species with an asterisk prefixed are new to the Society's Museum.

‡ Vide p. 887.

British Museum, labelled *Warry-atoo* from the Chittagong hills: and I may add, that a Neilgherry specimen of this animal which Mr. Elliot shewed me, at Madras, was so much finer than that mounted in the Museum of the Zoological Society, with horns so much larger and longer, that if I had not a very perfect recollection of the latter, in addition to possessing drawings of it, I might perhaps have hesitated in identifying them as the same; the head now sent, however, has the horns about equally developed with those on the Zoological Society's specimen.

The Birds presented consist of

**Aquila imperialis*, Temminck, vel *Heliaca*, Savigny; *A. chrysaëtos* of Mr. Jerdon's Catalogue.

**Ag. Vindhiana*, Franklin, *P. Z. S.* 1831, p. 114: young.

**Ag. pennata*; *Falco pennatus*, Auct.; *Spizætus milvoides*, Jerdon: young male. *Spizætus grandis*; *Nisaëtus grandis*, Hodgson, *J. A. S.* V, 230; *N. niveus*, Jerdon's Catalogue.

**Heteropus perniger*, Hodgson; *Aquila pernigra*, Ibid., *J. A. S.* V, 227; *Nisaëtus* ? ? *ovivorus*, Jerdon, Supplement to Catalogue, and indicated only in the latter as a Black Eagle frequently seen on the summit of the Neilgherries: male and female, the latter particularly fine.

**Pernis cristata*: a young male, white beneath,—a female in more advanced plumage,—and a male still more advanced.

P. Ellioti, Jameson: a female, nearly white below,—and a male in more advanced plumage.—*N.B.* I feel far from satisfied of the distinctness of these two alleged species.

**Limnæus punctatus*, Jerdon; olim *Spizætus punctatus*, Supplement to Catalogue.

**Buteo longipes*, Jerdon.

**B. rufiventer*, Jerdon, Supplement.

B. teesa, Gray and Hardwicke; *Circus teesa*, Franklin; *Astur Hyder*, Sykes: an adult female and young male.

**Circæus albidus*; *Falco albidus*, Cuvier, Temminck; *Buteo melanotis*, Jerdon, Supplement.

Circus Swainsonii, A. Smith; *C. pallidus*, Sykes: male.

Falco Juggur, Gray and Hardwicke; *F. Juggur*, Jerdon: young female.

Falco subbuteo, female; the European Hobby Falcon. In *J. A. S.* ante, p. 162, I attempted to cast a doubt as to whether the true Hobby inhabited this country, suspecting that the specimens referred to it had either been females or young of the nearly allied *F. Aldrovandi*, vel *severus*, Horsfield; but although there can be no doubt that the Darjeeling male *F. Aldrovandi* which I there described was correctly referred to that species, a more decidedly characterized specimen of the adult *subbuteo* which I killed on the wing very late one evening in the immediate vicinity of Calcutta, leads me, after much consideration, to identify not only Mr. Jerdon's specimen as specifically the same, but also the two which I described as the female and young female of *Aldrovandi* on the occasion cited. The two species must certainly be very intimately allied, and I regret that we do not possess a specimen of *Aldrovandi* that might now serve for further comparison, and also that I do not know, and cannot find a description of the immature plumage of this species, which probably approximates very closely indeed to the corresponding garb of *F. subbuteo*.

* *F. vesperlinus*, Lin.; *F. rufipes*, Tem.; *F. subbuteo*, Var. A., Latham, *Gen. Hist.* I, 121, being the only notice of an Indian specimen which I have met with previous to the present instance, which latter relates to that described in *J. A. S.* XI, note to p. 162, as a small red-billed Falcon procured upon the Neilghierries in January.

* *Accipiter minutus*?, Auct; *A. Besra*, Elliot and Jerdon: young male.

* *Astur Indicus*, Hodgson, 'Bengal Sporting Magazine,' 1836, p. 177; *A. palumbarius*, Jerdon, Catalogue, vide Supplement to the latter. A typical Goshawk, having an occipital crest: young male, and very fine old female.

* *Strix longimembris*, Jerdon.

* *Syrnium Sinense*.

Meseidus Newarensis, Hodgson, *As. Res.* XIX, 168; *Bulaca monticola*, Jerdon, Supplement: male.

* *Scops castanopterus*? Horsfield.*

Ketupa Leschenaultii.

Tephrodornis sylvicola, Jerdon.

* *Dicrurus macrocercus*, Vieillot; *D. annectans*, Hodgson.†

D. æneus, v. *muscipoides*, Hodgson.

D. retifer, Temminck, — *Malabaricus*, Gould, — *crystalinus*, Nobis, *ante*. Vide p. 799, *ante*.

* *Hypsipetes Neilgheriensis*, Jerdon.

Tricophorus virescens, Jerdon. So far as can be judged from the specimen, this does not appear to differ from *Tr. flaveolus*, Gould, *P. Z. S.* 1836, p. 6.‡

* *Tr. Indicus*.

* *Goldana* (G. R. Gray) *atriceps*; *Brachypteryx atriceps*, Jerdon.

* *Myophonus Horsfieldi*.

Petrocincla Manillensis, vel *Pandoo* et *Maal*, Sykes: male and female.

* *Turdus simillimus*, Jerdon; the Neilgherry Blackbird: male, female, and young.

* *T. (Oreocincla, Gould,) varius (verus)*, Horsfield; from the Neilghierries, vide Jerdon's Supplement.

* *T. Wardii*, Jerdon. A remarkably coloured species, from Mysore, connecting the Blackbird group with the *Oreocinclæ* of Gould.§ Length about eight inches, of wing four inches and three-quarters, and tail three inches and three-eighths; bill to forehead (through the feathers) an inch and one-eighth, and to gape an inch and three-eighths; tarse an inch: third primary longest, and a little exceeding the fourth, second and fifth equal, and first rudimentary. General colour deep black,

* A small species, procured in the vicinity of Madras. Mr. Jerdon, in a letter which I have recently received from him, doubts the propriety of my referring it, hesitatingly, to *Strix castanoptera*, Horsfield, remarking that Lesson has described the latter, from a Paris specimen, as a *Noctua*, and the description does not tally. It is probably a new species, and will be described as such by its discoverer.

† I have since obtained both this and the next species in the vicinity of Calcutta, where the latter is tolerably common in the cool season, and the former not rare. To the synonymes of *D. æneus* (p. 800 *ante*), add *D. æratus*, Stephens (p. 801 *ante*).

‡ Mr. Jerdon, however, to whom I have since forwarded a skin of *Tr. flaveolus*, considers them distinct, and I expect to receive other specimens from him of *Tr. virescens*.

§ The *T. mollissimus*, Nobis, *J. A. S.* XI, 188, links the *Oreocinclæ* with the *T. musicus* group.

with a conspicuous pure white eye-streak; all the wing-feathers broadly tipped with white, except the four first developed primaries, which have more or less of their outer webs white-edged; under-parts from the breast white, tinged with caraneous, the plumage of the flanks, however, only tipped with white: under surface of the wing marked with white, as in the *Oreocinclæ*: the upper tail-coverts are somewhat broadly tipped with white, and a tolerably large patch of the same is formed by the ends of the smaller wing-feathers: tail having its middle feathers but slightly tipped with white, the next largely, and the rest shewing successively more white on their inner webs, till on the outermost the feather is more than half white, being also, together with the penultimate, marked on the outer web with white towards the base. Bill dusky above and at the tip of the lower mandible, the rest yellowish: legs yellow. A female specimen.

* *Garrulax cachinnans*; *Crateropus cachinnans*, Jerdon.

Dasyornis striatus; *Megahurus striatus*, Jerdon, Supplement; *D. locustelloides*, Nobis, *J. A. S.* XI, 602.

Pellornium ruficeps, Swainson, *Fauna Americana-borealis*, II, 487; *Cinclidia punctata*, Gould, *P. Z. S.* 1837, p. 137; *P. olivaceum*, Jerdon.

* *Malacocercus Malcolmi*; *Timalia Malcolmi*, Sykes.

* *M. griseus*; *Turdus griseus*, Latham.

* *M. Somervillei*; *Timalia Somervillei*, Sykes.

* *M. subrufa*; *Timalia subrufa*, Jerdon.

* *Timalia hyperythra*, Franklin.

* *Trichastoma*, (Nobis, *J. A. S.* XI, 795-6,) *poiocephala*; *Timalia poiocephala*, Jerdon, Supplement.

* *Pomatorhinus Horsfieldi*, Sykes.

* *Saxicola nigrorufa*, Jerdon.

Dimorpha (Hodgson,) *leucura*; *Muscicapa leucura*, Latham, Swainson: adult, being the *Saxicola rubeculoides* of Sykes.

* *Phœnicura* (?) *major*, Jerdon, Supplement.

* *Calliope cyana*; *Larvivora cyana*, Hodgson, *J. A. S.* VI, 102; *Phœnicura superciliaris*, Jerdon, Supplement.

* *Curruca orphea*.

* *C. garrula*.

Phyllopeuste rufa.

* *Acrocephalus montanus*; *Sylvia montana*, Horsfield.*

* *Prinia sylvatica*, Jerdon.

* *P. socialis*, Sykes.

* *P. inornata*, Sykes.

* *P. gracilis*, Franklin.

* *P. rufifrons*, Jerdon.

* *P.* — n. s. Differs from *P. sylvatica* in its smaller size, the less grey but more fulvous hue of its upper-parts, shorter wings, and especially in its smaller and pale bill. Length five inches and three-quarters, of which the tail measures two inches and a half, and wings two inches and one-eighth; bill to feathers under half an inch, and above five-eighths of an inch to gape; tarse exceeding three-quarters of an inch.

* Not rare about Calcutta during the cool season.

Upper-parts slightly olivaceous brown, the tail obscurely barred, and its outer feathers successively more distinctly tipped with dusky and then whitish; under parts dull fulvous-white, except on the throat and middle of the belly, which are pure white; bill pale brown, darker near the ridge of the upper mandible; legs, also, in the dry specimen, pale reddish-brown; the crown a trifle darker than the rest.

Cisticola cursitans; *Prinia cursitans*, Franklin. This small species extends into Nepâl, where there is another nearly allied to it.

* *Parisoma*? *vireoides*, Jerdon: mutilated.

* *Motacilla variegata*, Vieillot, not of Latham: do.*

Muscipeta paradisea: a particularly interesting specimen, as demonstrating — what I have for some time been convinced of, from observation of the living birds, and especially their notes, — that this and the *M. Indica* v. *castanea*, Auctorum, are but different states of plumage of the same species, both sexes of which attain the white garb with full maturity, though breeding before they assume this livery. In the present specimen, a male, which is only sent for inspection and exhibition, as it belongs to a friend of Mr. Jerdon, the whole under-parts, some of the upper tail-coverts, and the upper tertiaries of the wings, are pure white, the last displaying the usual black markings, while the rest of the plumage is bright chestnut, except the head and neck, which are glossy green-black as usual; and it moreover does not appear that this bird was moulting, but that the individual had thrown out this intermediate garb at the last renewal of its feathers, a few of these (among the interscapularies) being partly white and partly of the chestnut hue of reputed *M. castanea*. One of our taxidermists assures me, however, that he has shot a male of this species during its moult, in which the chestnut feathers were all being replaced by white ones, and mentions particularly that one only of its long chestnut middle tail-feathers had been cast, and that a new white one was growing in its place. I may further add, that Mr. Hodgson has already presented the Museum with white and chestnut specimens, referring both to *M. paradisea*; and that I have seen a white male paired with a chestnut female, though more frequently pairs of the same colour associate. This bird is not uncommon in the vicinity of Calcutta at all seasons: and I have seen a nest of young ones, which were dull chestnut, with merely a slight indication of the black hood.

It was necessary to enter into the foregoing details, because in Col. Sykes's Catalogue of the Birds of the Deccan (*P. Z. S.*, 1832, p. 84), it is remarked that — “these two birds have lately been erroneously considered to belong to the same species. They were never found however by Col. Sykes (who shot many,) in the same locality, nor did he observe any intermediate state of plumage. The difference between the females of the two birds noticed above at once decides the distinction of species”! Both white and chestnut-coloured individuals may commonly enough be observed in the Calcutta Botanic Garden, and frequently about thick bamboos in other districts of this neighbourhood.

Muscicapa melanops: here not rare during the cool months.

* *M. albicaudata*, Jerdon.

* *M. superciliaris*, Jerdon; *Dimorpha* (Hodgson, but wrongly so located by me,)

* I have lately obtained a fresh, but much injured, specimen of this bird, taken by a shikaree, and am told that it is not very rare in the vicinity of Calcutta during the cool months.

albugularis, Nobis, *J. A. S.* XI, 190, where an allied species is described by the specific term *superciliaris*, which accordingly may now give place to *hyperythra*.

* *Pericrocotus*, (Boié, *Phænicornis*, Swainson,) *erythroptygus*; *Muscicapa erythroptygia*, Jerdon, Catalogue.

* *Crypsirina leucogastra*; *Dendrocitta leucogastra*, Gould.

* *Pastor fuscus*? Wagler; *P. Mahrattensis*, Sykes: very closely allied to, but distinct from, *P. cristatellus*, which latter is here common, but appears not to have been observed by Mr. Jerdon in the peninsula.

* *Spermestes* ———? No. 173, *bis*, of Mr. Jerdon's Supplement. Decidedly distinct from *Sp. leuconota*, as is also Mr. Hodgson's *Munia acuticauda*, *As. Res.* XIX, 153.

Corypha baghaira; *Alauda Dukhunensis*, Sykes: identical with the so called 'Ortolan' of this part.

* *Mirafra Javanica*: a specimen from Madras, according very well with the description by Stephens; and a specimen from the northern part of the Deccan, sent as the *M. Javanica* of Mr. Jerdon's Catalogue, which, it may be, is distinct, but the variation of plumage to which these birds are probably subject, requires further investigation.

* *Anthus rufescens*, apud Jerdon.

* *A. rufula*, ditto.

* *A. similis*, Jerdon.

A. agilis?, Sykes; identical with the Bengalese, Nepalese, and Malayan specimens which I have hitherto referred to *A. Malayensis*, Eyton. It may be either, so far as the descriptions go, which are both very deficient in the necessary measurements; and it is not unlikely that both descriptions refer to the same species, perhaps in summer and winter dresses respectively.

* *Cuculus sparveroides*: adult and young.

* *C. Sonneratii*; v. *C. Himalayanus* of Mr. Jerdon's Catalogue.

C. niger, Latham: v. doubtfully cited *C. flavus* of Mr. Jerdon's Catalogue, adult male and female.

* *Phænicophæus Jerdoni*, Nobis; *Xanclostomus viridirostris*, Jerdon.

* *Xanclostomus Sirkee*; *Eudynamys (!) Sirkee*, Hardwicke and Gray, and *Sirkeer Cuckoo* of Latham: female.

* *Cinnyris polita*; male and female.

* *C. minima*, Sykes: young male.

* *Dicaeum concolor*, Jerdon.

Arachnothera inornata; *Cinnyris longirostris*, Jerdon's Supplement.

Upupa epops, from the Neilghierries: this bird is common in the neighbourhood of Calcutta during the cool season, but in the peninsula is generally replaced by *U. minor*.

* *Chatura gigantea*; *Cypselus giganteus*, Temminck: a specimen from Penang; and another which I consider to be identical in species, from the Neilghierries. Very closely allied is the *Ch. macroptera*, Swainson, v. *Ch. nudipes*, Hodgson, *J. A. S.* V, 779; but this has constantly the whole chin and throat conspicuously pure white, forming a large and well defined patch, and the spinous extremities of the caudal feathers are much less developed than in the other.

I add a description of the specimens which I refer to *Ch. gigantea*. Presumed

length of the recent bird, (*i. e.* making due allowance for the skin being inordinately stretched lengthwise,) about eight inches and a half; of wing eight inches; and middle tail-feathers, to their spiny points, two inches and five-eighths. Back dull hair-brown, the head, neck, wings, and tail, dull iridescent black, and under-parts brownish, tinged with the same, especially about the breast; under tail-coverts, and line along the sides reaching to them, white; and chin slightly albescent, the loral feathers still less so. This description is taken from the Penang specimen; the Neilgherry one being a trifle less in length, its wing measuring seven inches and a half, and tail two inches and five-eighths. The chin is whiter than in the other, and the loral feathers are also white; but there is no other difference.

**Cypselus alpinus*, vel *melba*: from the Neilgherries.

**C. australis* (?), Gould, *P. Z. S.* 1839, p. 146; or a closely allied species, having the tail above half an inch shorter than is stated in the description cited: from Penang. Length about six inches and a half, of wing seven inches, and outer tail-feathers two inches and seven-eighths, the medial two inches and a quarter. General colour dusky-brown overlaid with shining green-black, the feathers of the breast and belly margined with whitish; rump white, having dusky shafts to the feathers; and throat and fore-neck whitish, being similarly shafted.

C. — ? A specimen from the Deccan, only differing from the last in being smaller, generally somewhat browner, particularly on the head and nape, and in having the abdominal feathers more slightly margined with whitish: the foot is, however, so decidedly smaller, that I cannot regard it as the young of the preceding species; bending the hind-toe backward, the span barely exceeds five-eighths of an inch, whilst in the other it is fully seven-eighths of an inch. Length five inches and a half, of wing six inches, and outertail-feathers two inches and a half, the medial an inch and three-quarters.

C. affinis, Hardwicke and Gray. A Neilgherry specimen is also sent as different from this, but which appears to me to be only the young of *affinis*. Length of wing four inches and three-quarters, and of tail an inch and five-eighths. Colour more brownish and less glossed than in the adult *affinis*.

**C. concolor*; *Hirundo unicolor*, Jerdon, Catalogue, but since correctly referred in the Supplement to the latter to the present genus, wherein already a distinct *C. unicolor*, from Madeira, has been figured and described by Messrs. Jardine and Selby, in their 'Illustrations of Ornithology,' Pl. LXXXIII, for which reason I have altered the specific name bestowed by Mr. Jerdon on the present species.

**Hirundo domicola*, Jerdon, Supplement.

**H. urbica*: from the Neilgherries.

**H. inornata*, Jerdon, Supplement.

**H. concolor*, Sykes.

**Vinago aromatica*, female; being the *V. affinis*, Jerdon, Catalogue, where the *V. unicolor*, Jerdon, is likewise the female of *V. bicincta*, Jerdon.

Carpophaga œnea.

**Ardea nigra*, Vieillot.

A. lepida, Horsfield.

Porzana rufescens; *Rallus rufescens*, Jerdon: also met with in the vicinity of Calcutta.

**P.* — ? New species. Allied to the last, but smaller, and otherwise differing.

Gallinula chloropus (?), var. *Indicus*; male, sent as *G. akool*, Sykes. This bird is common enough in the vicinity of Calcutta; and it appears to me, judging from memory, to be constantly inferior in size to the British species. As in the latter, the female is larger and much finer-coloured than the male. A handsome adult female measured twelve inches and a quarter long, by nineteen inches and a half in spread of wing: in Dr. Fleming's 'British Animals', the dimensions of the European bird are given as — "Length fourteen inches; breadth twenty-two inches"; but Mr. Jenyns assigns only thirteen inches by twenty inches and three-quarters, which are probably the admeasurements of the European male bird. In other respects there appears to be no difference whatever.

Machetes pugnax; sent as *Tringa Hartwickii*, Gray, which is evidently the Ruff in winter dress, as *T. Indica*, Gray, is the female or Reeve.

**Charadrius russatus*, Jerdon.

**Strepsilas interpres*.

From the Barrackpore Menagerie, we have received a specimen of a young Sambar Deer (*Cervus hippelaphus*).

I now proceed to describe the small Bootan Squirrel, which has been already mentioned (p. 880) as being nearly allied to *Sciurus insignis*, Horsfield, and to the Neilgherry *Sc. Delesserti*.

Sc. Pembertonii, Nohis. Total length nine inches, of which the tail with its hair measures four inches; tarsus, to end of claw of longest toe, an inch and one-eighth. General hue of the fur dull brownish-fulvous, grizzled with black, and slaty-black at base; under-parts albescent-brown: a black stripe on the nose, anterior to the whiskers which are also black; another black mesial stripe commences between the shoulders, and is continued to the croup, besides which is a narrow lateral black stripe, adjoining a broader pale fulvous one external to it, which commences on the side of the neck, and is continued to that of the base of the tail, becoming narrow over the croup: the ears are rather small, and are lined internally with minute close fulvous-white hairs; their edges are black; and the fur outside the ears is longer, and terminates in a white tuft which shews conspicuously, contrasting with the black edge of the ear: the tail is grizzled nearly like the back, but black predominates on its upper surface, and fulvous on the lower: orbits fulvous; and feet coloured like the sides.

I may also here describe another small rodent, presumed to be from the Himalaya, which I shall designate

Georychus fuscocapillus, (vide *J. A. S.* X, 928), or Dusky-capped Lemming. Length about four inches, exclusive of the tail which measures a quarter of an inch, or with its hair half an inch: tarse, to end of claw of longest toe, seven-eighths of an inch. Ear-conch very minute, and concealed underneath the fur: the latter is of an Isabella colour at the surface, or nearly that of *Bathyergus maritimus*, but slaty-black for the basal two-thirds; the upper part of the face and head being dusky brownish-black, which gradually passes into the hue of the body: whiskers reaching to the ears, a few of the anterior being whitish, and the rest dusky. The rodentia tusks of this species are pure white, and the upper pair project very remarkably forward.

Having taken a fortnight's excursion up the river since our last Meeting, and gone much on shore to observe and collect whatever fell in my way, a few remarks on the

Zoology of the district as observable during the latter part of July, when the rainy season has moderated, though heavy showers are still of frequent occurrence, leaving periods of sunshine at most but of a few hours' duration, may be acceptable to some readers of the Journal in Europe, who may not be prepared to hear of the remarkable paucity of animals which fell under my observation, in a region so generally understood to teem with animal life at all seasons.

I may notice that, keeping on shore almost constantly while the weather permitted it, I did not advance above fifty or sixty miles above Calcutta; the country being almost everywhere so thickly populated that it was dangerous to point a gun near the ground: to this cause, however, must not be attributed the scarcity of birds in particular, so remarkably noticeable during the epoch of the rains, for the contrast in this respect presented during the cold season is very striking.

There was a total absence of water-fowl upon the river; and the only species of wading or water-fowl observed on land, were a few Egrets (*Paddy-birds*) of different species in the rice-fields, with occasionally an *Anastomus* seen on the wing, and now and then a solitary *Ardea Javanica* would be put up from secluded tanks generally surrounded by jungle; I also observed two or three individuals of the larger Whistling Duck (*Dendrocygna major*, Jerdon), a pair of the Pygmy Greenshank (*Totanus Horsfieldi*) on the margin of a brook, and the only *Rallidæ* seen were two or three individuals of *Gallinula Javanica vel phœnicura*.

The *Raptors* were not more extensively represented. The White-backed Vulture (*Vultur leuconotus*, of which *V. Bengalensis*, Auct., is merely the young,) was duly numerous, collected wherever there was, or had been, aught to entice its appetite, or sailing in quest of such delicacies high in the bright sunlight. The *Haliaeetus Pondicerianus* ('Brahminee Cheel'), so very numerous at other seasons, was seen only once or twice; and the common Indian Kite (*Milvus cheele*), which literally swarms in Calcutta during the greater part of the year, quits it entirely at the time of the rains, and of this I saw two or three individuals high in air: the only remaining bird of prey observed was *Circæus undulatus*, a pair of which were hovering over Barrackpore park, and another was shot some miles higher up the river.

There are five species of Parrot more or less common in this neighbourhood throughout the year; viz. *Palæornis Alexandrinus, torquatus, mystaceus*, and *Bengalensis*, and *Psittacula vernalis*. *Pal. torquatus* is the most numerous, and *P. Bengalensis* next so; these I have marked down in my list as having been observed on the present occasion, as also a large flock of what appeared to be the little Crimson-rumped Lorikeet (*Psittacula vernalis*).

Of Woodpeckers, *Picus Bengalensis* is extremely abundant at all seasons, and *P. Macei* less so: in addition to these was obtained *P. badius*, Raffles, which is not common in this part of Bengal, though I had before observed it. Of Cuckoos, *Cuculus fugax* was numerous, *Oxylophus edolius* less so, and *Centropus Phillipensis* common. *Bucco cyanops* and *B. Phillipensis* abundant. The Kingfisher tribe was as plentiful as at other seasons, consisting of *Halcyon Capensis*, tolerably common, *H. Smyrnenensis*, *Ceryle rudis*, and *Alcedo Bengalensis*: the fine *Halcyon amauropterus*, Pearson, (*J. A. S. X.*, 635), which is tolerably common near Calcutta during the cool season, I did not observe. The Roller (*Coracias Indica*), so very plentiful in the cool months, had almost disappeared: and the pretty little green Bee-eater (*Merops*

Indicus), which during the cool season is one of the very commonest birds we have, had not been once seen by me for two or three months in places where it had abounded, when in the course of my late excursion I observed three or four upon one occasion hawking over a paddy field. Of Swifts, we have two species common throughout the year; viz. *Cypselus affinis*, Gray, which frequents towns, and is chiefly seen in their immediate neighbourhood, and *C. palmarum* which mainly affects rural districts, building its nests within the fronds of the fan-leaved palms, sometimes twenty or thirty pairs of them associating in those of a single tree, while it is also rare to meet with one of the same palms clustered with the pensile nests of the Baya, (*Euplectes Phillipensis*,) that does not also harbour two or three pairs of this elegant little Palm Swift.

Among the perchers, the common Indian Crow (*Corvus splendens*, Vieillot), the common Mynah (*Pastor tristis*), and the common House Sparrow (*Pyrgita domestica*), were, of course, everywhere abundant about habitations. No other Mynah or allied bird fell under my notice, except the Pied Starling (*Sturnus contra*). The Indian Black Crow (*Corvus macrorhynchos*), was here and there seen along the river bank; *Crypsirina vagabunda* in the trees. In the various green lanes, orchard-gardens, and other most likely places to meet with small perching birds in general, scarcely a chirp could usually be heard, and not a bird be seen for perhaps five or ten minutes together: but *Columba tigrina* was numerous in most places, perpetually uttering its coo, and about the most conspicuous feathered inhabitant of this part of Bengal throughout the year is the gregarious and noisy *Malacocercus terricolor*, (Hodgson, here called *Chatarrhœa*, or, oftener, *Saat Bhye*, vide *J. A. S. X*, 650); the tiny but loud chirping Tailor-bird (*Orthotomus Bennettii*), and the various-chirping *Iora typhia* vel *scapularis*, are other conspicuous species at all seasons; also the Indian Black-headed Oriole (*Oriolus Hodsonii*, apud Swainson), and two species of Bulbuls (*Hæmatornis* of Swainson, the *Ixos Cafer* and *I. jocosus*, Auctorum). The assemblages of Bayas (*Euplectes Phillipensis*) all but invariably select a fan-leaved palm wherefrom to hang their curious and beautifully constructed nests, preferring the immediate vicinity of human abodes; but on one occasion I noticed a number of these pensile nests upon two small exogenous trees, which stood alone near the margin of a rice-field. Small flocks of *Pyrrhulauda crucigera* were occasionally put up in the rice-fields; and among conspicuous species should not be omitted the Fingah (*Dicrurus Fingah*), though it appeared to be considerably less numerous than at other seasons; the Butchanga of the Bengalees (*D. æneus*) was likewise met with. The Dial (*Copsychus saularis*), whose pleasing song reminds one of the Robin of Europe, though inferior in quality, being intermediate to that of the British Robin and Redstart, was also frequent; *Muscipeta paradisea* seen now and then; small troops of *Pericrocotus peregrinus* not rare; and the restless Dusky Fantail (*Rhipidura fusciventris*) moderately common; this bird has a very pleasing, short and tinkling, song. I obtained one specimen of *Tephrodornis superciliosus*; and observed two or three individuals of *Anthus agilis*, which in the cool season is most abundant. Finally, upon the blossoms of the cocoa-nut palms, were seen feeding the brilliant little *Cinnyris sola*, which was tolerably plentiful, its weak chirp and song recalling to mind those of a *Regulus*, and the dull-coloured *Dicaeum Tickellie*, Nobis (or *Nectarinia minima*, Tickell, *J. A. S. II*, 577), which was less abundant. *D. ery-*

thronotum had also been procured by me a few days previously to this small excursion.

The foregoing brief list comprises all the species of birds I remarked, during daily rambles of several hours; and very scantily were they, in general, dispersed. Of mammalia, the common species were, of course, the Jackal, and the Palm Squirrel and Musk Shrew about habitations. I obtained the *Gerbillus Indicus*, for the first time I had seen it from Bengal, and learned that it was not uncommon about rice-fields. Of Bats, nothing new was met with, at least additional to what I have procured in the immediate vicinity of Calcutta. I observed the Hoonuman Monkey (*Semnopithecus Entellus*) in great numbers, along the banks of a nullah about fifty miles from this metropolis; scarcely less tame than domestic animals, and a great annoyance to the villagers whom they plundered incessantly. As soon as my boat was moored, the trees around and almost hanging over were crowded with them, peering with curiosity, though not unmixed with distrust; nor without due cause, for desirous of getting a fine specimen for the Museum, I soon brought one down, and the villagers, to my considerable surprise, gave every encouragement to shoot others, although themselves would not think of doing so. The sacculated stomach of this individual was quite filled with *finely masticated foliage*, a diet which the conformation of the molar-teeth and stomach in this genus had led naturalists to suspect these animals more or less resorted to,* though the actual fact of their doing so had not, I believe, previously been ascertained. These Monkeys were perfectly at home upon the huts of the villagers, and their surprising agility recalled forcibly to mind M. Ruppell's description of the habits of *Colobus Guereza*.† Their deep and loud, heavy voice, calling to one another among the trees, could be heard to a great distance.‡

Of Reptiles, I scarcely met with anything. The pretty *Calotes Tiedmanni* was now and then seen, and once a sort of Scinque, under a fallen tree, which I failed in secur-

* Vide Mr. Owen's paper on the stomach of the present species, published in the Zoological Society's *Transactions*, Vol. I.

† The *Colobi* have recently been ascertained by Professor Owen to resemble the *Semnopithecus* in the conformation of the stomach.

‡ The following very interesting observation relative to the habits of the *Semnopithecus Entellus*, I quote from the 'Bengal Sporting Magazine' for August 1836, page 98.

"In the extensive jungles which exist in the Burdwan district, the large black-faced Monkey, the *Hoonuman* I believe of the natives, is found in considerable numbers, as also in the topes or groves which are scattered over the cultivated parts of the country: which latter circumstance has afforded the means of remarking the curious method which is observed by these animals, for regulating the sexual intercourse of the species. The Monkeys are always found in packs occupying particular trees, and it is remarkable that, in each, only one adult male will be found; the remainder consisting of females and their young. It is also surprising that this individual should exhibit great animosity towards the male young, pursuing them on every occasion, and never failing to destroy them when they unfortunately fall into his power. To obviate this, the mothers make use of many ingenious expedients, keeping their progeny as much as possible out of sight, and when hotly pressed, throwing them from one branch to another into the hands of other sh-monkeys, who take charge of them with as much solicitude as if they were their own. The young female monkeys, on the contrary, are not molested in the least.

"At a particular season of the year, the great body of he-monkeys, which had been leading a monastic life deep in the woods, sally forth to the plains, and mixing with the females, a desperate conflict ensues for the favours of the latter. This continues for several days, at the end of which

ing. A large Cobra was observed swimming in the river, but no other snake whatever. Of *Batrachia*, I procured a few Tree-frogs (*Hyla maculosa* of Hardwicke and Gray), which passed the day asleep upon low herbage; also a species of Toad undetermined, additional to that common about Calcutta, and the young of a third species.

Of Fishes, nothing but what is common in the Calcutta bazars.

A few *Testacea* and *Crustacea* were collected, and a considerable number of fine Insects, particularly *Orthoptera* and *Lepidoptera*, but not many species additional to what I had previously met with.

Such is a brief summary of the products of a fortnight's quest for specimens to enrich the zoological collections in the Society's Museum, undertaken, however, chiefly for purposes of observation, to which collecting was regarded as subservient. Of course there were many species which eluded observation, but fewer of birds than of the other classes, whence my list of these will tolerably well illustrate what are to be met with in this part of Bengal at the season when birds are rarest. The frequency of the rain was a great impediment to carrying on any researches of the kind, by rendering many places impassable alike under-foot, and drenching the bushes and under-wood, so that traversing them was as bad as experiencing the effects of a shower; but my little party did their best towards securing whatever they could for the Museum, and while the showers fell, there was work enough inside the boat in preparing what specimens had been collected. I do not, however, recommend any other party to select the same season for similar investigations.

With much respect,

I now subscribe myself,

Yours obediently,

EDWARD BLYTH.

time, one male, more valorous or strong than the rest, will be found in possession of the whole female part of the flock, his discomfited fellows remaining at a short distance from the scene of their defeat. An interesting scene now follows: a kind of conference takes place, the female monkeys delivering up their half-grown male offspring to the care of the former, who troop away to the jungles, reinforced by the juniors, who at the next season return with their foster-fathers to take part in the contests which ensue on their periodical migration."

Though rather out of place here, I shall cite another observation from the same work (for September 1836, page 158), relative to the habits of the Rhinoceros, concerning which it would appear that the nasal horn is not the most formidable weapon of this powerful beast. "At one time," remarks the writer, "I thought it was so, but have long been satisfied that it is merely used in defence, and not as an instrument of offence. It is with the tusks they wound so desperately. I killed a huge male, which was cut and slashed all over its body in fighting; the wounds were all fresh, and as cleanly cut as if they had been done with a razor,—the horn could not have been used here. Another we had wounded, stood, and out of pure rage, cut at the jungle right and left, exactly as a hog uses his tusks. One of my friends had a man, who was sauntering through the forests, actually embowelled by a Rhinoceros. He examined the wound immediately, and I heard him say afterwards, that, had it been done with the keenest cutting instrument it could not have been cleaner cut;—that could not have been with the horn." Other facts to the same effect have been related to me by a sporting friend, who has had considerable experience in Rhinoceros hunting; and since transcribing the above, I see that Mr. Robinson mentions, in its 'Descriptive account of Assam,' p. 97, that "the Rhinoceros makes no use of its horn as a weapon of defence, but for this purpose invariably uses its teeth."

I may also here notice, that I have just ascertained the fact of a plurality of species being, there can be no doubt, confounded under the appellation of *Hoonuman*, which greatly detracts from the value of what had been hitherto ascertained regarding the geographic range of the alleged *Semnopithecus Entellus*. January 20th, 1843.—E. B.

Read the following letter from the Curator of the Museum Economic Geology.

H. TORRENS, Esq. *Secretary, Asiatic Society.*

SIR,—Upon examining the official reports of the late Dr. Voysey, I learn, that with that of 8th August 1821, (Cons. of 21st August 1821,) he forwarded a Geological Map, which was soon after sent to the Honorable the Court of Directors. No record appears of any copy having been made to retain here.

I beg therefore to suggest, that the Society apply to Government to obtain for us copy of this and any other of Dr. Voysey's Maps or Plans, as being documents of the highest possible importance to us, and in fact, almost the only existing materials we have for a Geological Sketch Map of much of that part of India.

I am, Sir,

Your obedient servant,

H. PIDDINGTON,

Curator Museum Economic Geology.

A copy of the foregoing letter was forwarded to the Secretary to the Government in the General Department, on the 27th August last, with a request that copies of the Geological Maps of Dr. VOYSEY alluded to, may be procured from the Honorable the Court of Directors, for the use of the Museum Economic Geology. The Secretary reported, that assurances had been held out for a compliance by the Government with the request of the Society.

Read the following report from the Curator Museum Economic Geology:—

Report of the Curator Museum of Economic Geology for the month of August.

Museum Economic Geology.—I announced in my last report an ore received from Major Ouseley, Agent to the Governor General S. W. Frontier. As I supposed, it has proved to be an argentiferous ore, of sulphurets of lead and antimony in varying proportions, with iron pyrites in a quartz matrix. I obtained from 500 grains of the ore, fairly taken as an average, one and a half grain of muriate of silver, equal to one grain of pure silver. This would give about 70 oz. of pure silver to a ton of well picked ore, which in England would be worth working. I have written to Major Ouseley for more specimens, (those sent being merely the out-crop of the vein,) when we may perhaps find ores of a quality better worth attention; the presence of the antimony being a favourable indication.

We have received from Miss Lloyd, (Darjeeling,) a white earthy powder found in the bed of one of the mountain streams, and used by the Lepchas to whitewash their houses. Upon analysis, this substance is found to be composed of

In 100 Parts.	{	Carbonate of Lime,	55.20
		Carbonate of Magnesia,	19.04
		Alumina,	6.00
		Silex,	8.00
		Iron,	None
			98 24
		Loss,	1.76
			100.00

In a separate report on this mineral, addressed to our Secretary, I have pointed out the importance of examining the sediments below these deposits, and the river courses above them, so as to trace the rock, and to ascertain if any metallic ore exists in it or in the sediments.

The earthy deposits would make good lime, which is so great a desideratum at Darjeeling.

From Government we received in July, (in which month's report it was omitted by an oversight,) a report by Captain Campbell, Assistant Surveyor General, on the Natural History of Southern India, with two specimens manufactured by himself, from the iron sand of that quarter.

Our zealous member, G. T. Lushington Esq. Commissioner, Kemaon, has also sent us a valuable collection of sixty-four specimens of ores of iron, copper, and lead from Kemaon, which, with the foregoing, are upon the table.

From Mr. Garnier, Engineer, through our Secretary, we have received a specimen of the rose-coloured sienitic granite of the interior of the Pyramids, and one of the limestone from the exterior of them.

Geological and Mineralogical Museum.—I have been continuing the arrangement of the minerals, and we have received herein from the Reverend J. H. Pratt, Chaplain to the Lord Bishop, an excellent little series of fifty-six Geological specimens from Gwalior to Jubulpoor in Bundelcund, comprising several curious and instructive specimens of the Geology of that interesting tract of country.

From Mr. Garnier also, we have a specimen of fossil wood, from the large deposit of it in the Desert between Cairo and Suez.

H. PINDINGTON,

Curator Museum Economic Geology.

No. 465.

To H. TORRENS, Esq.

Secretary to the Asiatic Society.

General Department.

SIR,—I am directed to transmit to you, for the Museum of Economic Geology, the accompanying copy of a Letter and Report by Captain Campbell, Assistant Surveyor General at Madras, on the manufacture of Natural Steel in Southern India, received from the Government of Madras, together with the specimens of Steel therein referred to.

I have the honor to be,

Sir,

Your most obedient Servant,

H. V. BAYLEY,

Deputy Secretary to the Government of India.

COUNCIL CHAMBER, the 15th June, 1842.

No. 496.

Fort St. George, 30th May 1842.

To the Secretary to the Government of India.

Public Department.

SIR,—I am directed by the Right Honorable the Governor in Council, to transmit to you, for submission to the Supreme Government, copy of a report upon the manu-

facture of Natural Steel in Southern India, received with the accompanying letter from Captain Campbell, Assistant Surveyor General, dated 9th instant.

I have the honor to be &c.

(Signed,)

H. CHAMIER,

Chief Secretary.

(Copies.)

To the Secretary to the Government of Fort St. George, in the Public Department.

SIR,—With reference to a report in October 1841, I have the honor to forward a report on the “Manufacture of Natural Steel in South India,” which I request may be laid before His Lordship, the Right Honorable the Governor in Council.

2. Accompanying I have also forwarded a small piece, as a sample, of this steel in the rough state, after having been forged, on removal from the furnace; as also a piece made up into the shape of a Native carpenter’s chisel, which has been in use long enough to prove, that the steel will bear a temper as good, if not better, than that of similar articles made in England.

3. The purposes to which this steel might be applied, and in which the Government must now expend vast sums of money are very numerous; viz. ramrods for muskets, axes, hill-hooks, and jumpers for the corps of Sappers and Miners, the various tools of artificers, &c. &c. all of which could be made with iron and steel manufactured in India, for very much less than they now cost from England.

4. With reference to my proposal to undertake to manufacture iron, I shall be happy at the same time to undertake to supply this steel at the rate of 150 rupees per ton, and in quantities probably as large as can be required.

5. I have the honor to remark, that in specifying the above rate for the cost of the manufacture of this steel, and also of the iron, without requiring any further outlay on the part of Government, I have been guided by the *certain* results of my experiments, so as to secure myself against any loss, and do not deny, that the rates mentioned, will probably afford me a very handsome remuneration; but that should His Lordship, the Right Honorable the Governor in Council, be pleased to have sufficient confidence in my knowledge and information in the various branches of physical science, to recommend that I should be employed to institute the manufacture in question, at the risk and immediate expence of Government, I shall be happy to endeavour to economise the expence of manufacture to the lowest possible rate, which I am led to believe might be reduced as low even as 60 rupees per ton, as I hope in that case that there may be no objection to a proportionate increase of my monthly salary.

6. In presuming to propose the institution of my manufactures in question, I am quite aware that it has been stated as a dogma by political economists, that it is objectionable for a Government to meddle with the manufactures of a country, or to attempt unnatural fostering of any particular branch; but with deference, I beg to be allowed to suggest, that a sufficient distinction has sometimes not been made between fostering a trade, and fostering the dissemination of the knowledge necessary

to establish, or to improve a trade. In Europe, of course the latter can never be requisite; but in the present state of India, I believe it will be allowed, that without the fostering aid of Government, no new manufacture can be introduced in which natives of the country may be expected to participate.

7. In the present instance there is no one acquainted with the theory or practice of the processes which I employ, and even if they were well known in Europe they could never be put in practice in India; because being very simple, it is more than probable that in less than five years, the natives will have learned and taken them out of the hands of the first institutors, while the modes of manufacture common in England, which from the great expence of the furnaces, &c. required, are retained in the hands of capitalists, cannot be generally employed in India, in consequence of the manner in which the ore and fuel are distributed through the country.

I have the honor to be, &c.

(Signed) J. CAMPBELL, *Capt. Assistant Surveyor General.*

RYACOTTAH, 9th May 1842.

Report upon the manufacture of Natural Steel in Southern India. By Captain CAMPBELL, Assistant Surveyor General, Madras Establishment.

1. In England, steel is made by cementing bars of Swedish or Russian iron, at a high temperature, while embedded in powdered charcoal. In this manner the cheapest kind is produced called "blister steel."

2. By drawing out this steel into small bars under a "tilt hammer," the quality is much improved, and it is then called "tilted steel;" and by combining bars of "blister steel" at a welding heat, and drawing them out under the hammer, "shear steel" of still better quality is formed, and by fusing pieces of blister steel together in a crucible "cast steel" is produced, which is the finest kind of steel made in England.

3. The wholesale prices of the above varieties of steel in the English market vary from 30 to 80*l* per ton, and blister steel is sold at Madras in retail, at the rate of 560 rupees per ton.

4. In Mysore, steel is made by a process which admits of considerable improvement, and is sold in retail at the rate of 373 rupees per ton. In quality this steel is sometimes far superior to any English steel, but as considerable practical knowledge is required to select the good from the bad, and as the quality is very uncertain, it is not probable that while the manufacture remains in the hands of natives, it can ever supersede the use of English steel.

5. The cheapest steel made in India, sells at about 233 rupees per ton, and being of very inferior quality, it is only used by the natives for making axes and bill-hooks.

6. In Germany and Styria, a kind of steel has long been made, by treating cast iron in a particular manner, called "natural steel," or "German steel," which at one time was imported largely into England, and is still used on the Continent, in

consequence of its cheapness, for all rough purposes, such as tipping ploughshares, making axes, &c. &c.

7. This kind of steel is not made in England, in consequence of the bad quality of the iron made from the commoner ores of England.

In a former report, I have shewn that this "natural steel" can be produced immediately from the ore in smelting the "iron sand" of South India, at a very cheap rate; but on further investigation of the process, I have found that by treating the cast iron procured from this ore, in a manner similar to the German methods, a natural steel can be produced without any uncertainty in the result, for less than 150 rupees per ton, which is less than iron now sells for in South India.

9. By experiments on steel which I have made in this manner, I have found that it is fitted for every purpose for which natives now use steel, while the process is so very simple, that it can be learned and practised by natives with very little difficulty, and the apparatus requisite costs hardly any thing.

(Signed,) J. CAMPBELL. *Capt. Asst. Surveyor General.*

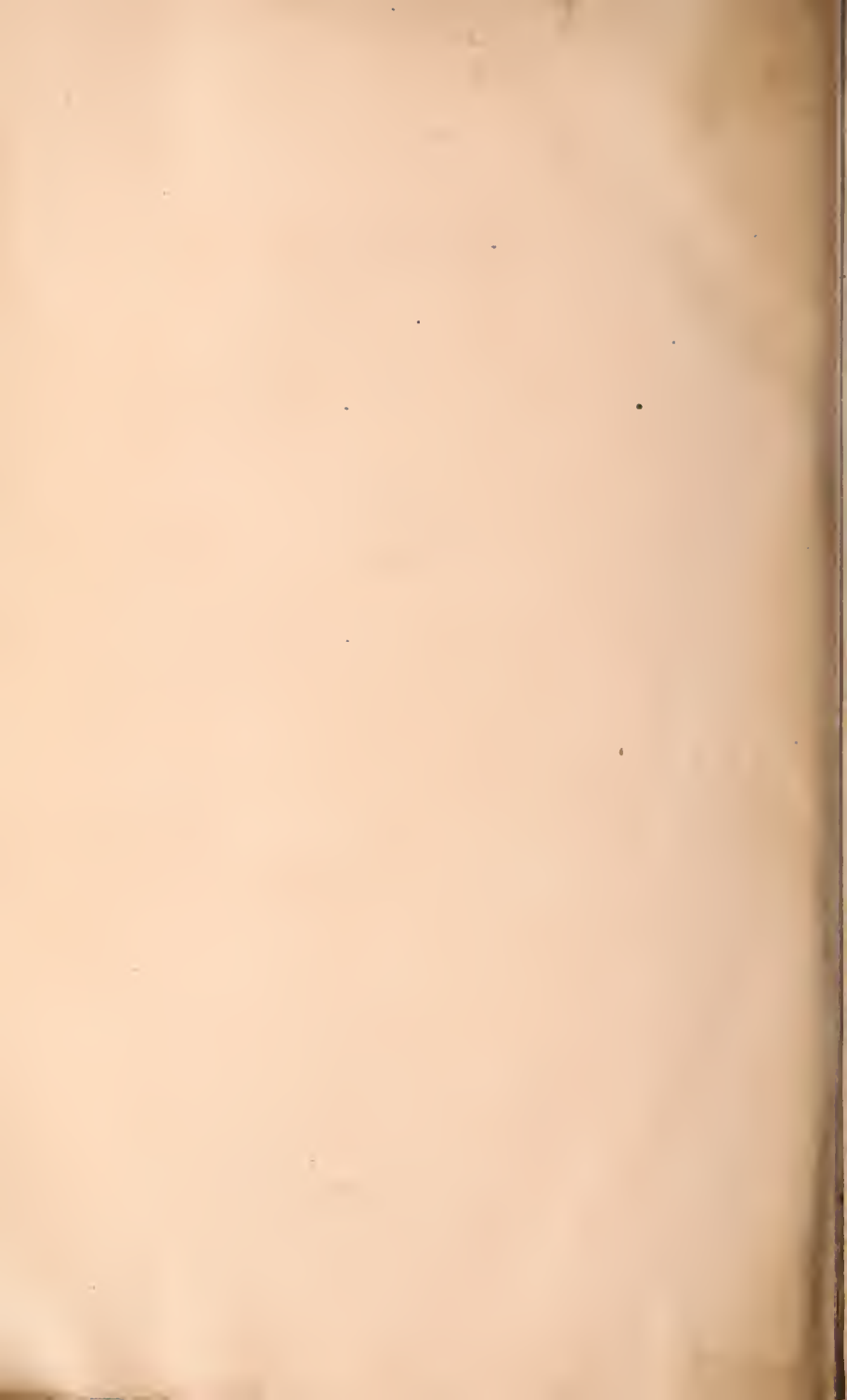
RYACOTTAH, 9th May, 1842.

(True Copies.)

(Signed) H. CHAMIER, *Chief Secretary.*

(True Copies.)

H. V. BAYLEY, *Dept. Secy. to the Government of India.*



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